stuffed skins at present known to exist*. I do not, however, mean to prolong these remarks by making any observations on the osteological structure of this bird. That I have reason to hope may be fully described by a far more able pen; for it is my intention to place the specimen I now exhibit in the hands of Professor Owen, trusting that he will make it the subject of one of those monographs which have so materially enriched our series of 'Transactions.' I have but to say in conclusion that, so far as I know, my "mummy" is, with one exception, the only approach to a complete skeleton existing in Europe. That exception is the specimen, nearly perfect, in the Osteological Gallery of the Museum of the Jardin des Plantes at Paris; for the remains of the two Gare-Fowls killed on Eldey in 1844, which were sent to Copenhagen, and are still preserved in the Physiological Museum of the University there, have been dissected with a view to show the different systems of organs; they are therefore even less available to determine the general osteology of the bird than are the various loose bones which, through Stuvitz's labours, exist in the Museums at Christiania and Copenhagen, that of our Royal College of Surgeons, and in my own collection.

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November 24, 1863.

John Gould, Esq., F.R.S., in the Chair.

The Secretary exhibited a specimen of variegated wool from Ohio, forwarded by Mr. J. P. Hazard, of Philadelphia, through Mr. C. R. Weld, which seemed to show that the animal must have changed its colour some seven or eight times in the course of the year prior to its being clipped.

Professor Tennant exhibited a very perfect fossil egg of the *Æpyornis maxima*, lent to him for exhibition by M. J. F. Brunet. This egg, which measured 35 inches in larger by 29 in smaller diameter, was stated to have been obtained in Madagascar, "at a depth of 50 feet, in digging a mine of iron."

The Secretary read the following letter from Dr. J. Shortt, F.Z.S., relating to the fishing-propensities of the *Pteropus* of India:—

"Sir,—At about 6 P.M. on the 30th of April last, when at Con-

* Mr. Blyth, just six and twenty years ago, exhibited to this Society some bones which had been left in a preserved skin of this bird (P. Z. S. 1837, p. 122; and Ibis, 1861, p. 396, *note*). Within the last year, Mr. John Hancock extracted from his own beautiful specimen, and from the very ancient and interesting example in the Newcastle Museum, *every bone* they contained, without doing the slightest damage to the skins, as might be seen at the late Meeting of the British Association (*Cat. of Exhibition*, nos. 180, 185).

leeveram, my attention was attracted to a tank next the Dispensary, which, owing to a light shower of rain that had just fallen, literally seemed alive with small fish gambolling and jumping about in the water. There was nothing new in this; but my attention was drawn to a number of large birds with a somewhat heavy flight, hovering over the water and seizing with their feet the fish, with which they then made off to some tamarind-trees on the bund of the tank, to devour them at their leisure, I suppose.

"On a closer examination, I discovered that what I had imagined mere birds were none other than Flying Foxes, the *Pteropus edulis*. After watching them fishing for some time, I had to leave, owing to the darkness of the evening. I returned to the tank the next evening half an hour earlier, and again witnessed the same occurrence.

"I then got my assistant, Mr. Watson, to bring his gun and shoot some, so that I might satisfy myself as to the identity of these animals. Mr. Watson shot some two or three whilst in the act of seizing their fishy prey, and on examination I found them to be actually Flying Foxes. During a second visit, on the 5th and 6th of June, I observed the same thing occur again.

"I am not aware of the fishing-propensities of this animal ever having been noticed, for I find no account of them in any work on natural history that I have had opportunities of consulting on the subject. This habit of the Flying Fox appearing new to me, I send you this communication, as there may be others who have witnessed the same thing; and if made known, this would, I am sure, prove of interest to the naturalist.

"Chingleput, June 12th, 1863."

The Secretary regretted to have to state that one of the two *Didunculi* mentioned by him at the last Meeting as having been purchased at Sydney by Dr. G. Bennett for the Society was dead; but Dr. Bennett had promised to send home the dead specimen, as well as the remaining living bird, at the first suitable opportunity.

The Secretary also read the following extract from Dr. Bennett's latest letter (dated Sydney, Sept. 19th), respecting the Kagu of New Caledonia (*Rhinochetus jubatus*):—

"My young friend Mr. Ferdinand Joubert thus writes to me from 'Kai,' in the interior of New Caledonia, August 2nd, 1863:—

"'I see in the 'Sydney Herald' your article on the Kagu. I will send you some of the birds as soon as I can procure them, and also some nests and eggs, if pipes and tobacco can induce the natives to bring me some. The Kagus are rather plentiful here, on the side of the "Boh" Mountains, and the natives catch them to eat. Their way of doing this is by making a slipknot on a strong string; and having discovered a place frequented by these birds, they fasten the string in such a way that the birds when running along pass their heads or legs through the noose and are thereby captured. There are two kinds of Kagus, one very different from the other. The largest Kagu you last received from Dr. Segol is a female of the

"Bush-Kagu," and, as you have remarked, much handsomer than its fierce friend the smaller Kagu, which is the one with the dark stripes on the wings and tail (and generally of darker plumage). This is the "Grass-Kagu." These two kinds of Kagu do not associate together on good terms; and during the time I had them they were always fighting one with the other, the "Grass-Kagu" invariably getting the worst of the battle.

"'I will endeavour to procure a male and female of each species, and send them to you as soon as I can.'

"This fighting-propensity may in some degree account for the death of the little pugnacious Grass-Kagu soon after its arrival. It was found in a miserable half-starved condition when dissected; whilst the larger, elegant, and more peaceful 'Bush-Kagu' was in fine plumage, plump, and altogether in a healthy state, which continues to the present day.

"I have since written to Mr. F. Joubert, requesting him to send me as soon as possible a pair of skins of each species, male and female, properly labelled, and living specimens in pairs, as soon after as they can be procured, when I will transmit them to you immediately, so as to decide this interesting doubt on the subject of the existence of two species of this singular bird."

Mr. F. Buckland gave an account of his recent experiments in conveying a Porpoise (*Phocæna communis*) from the seaside to the Society's Gardens.

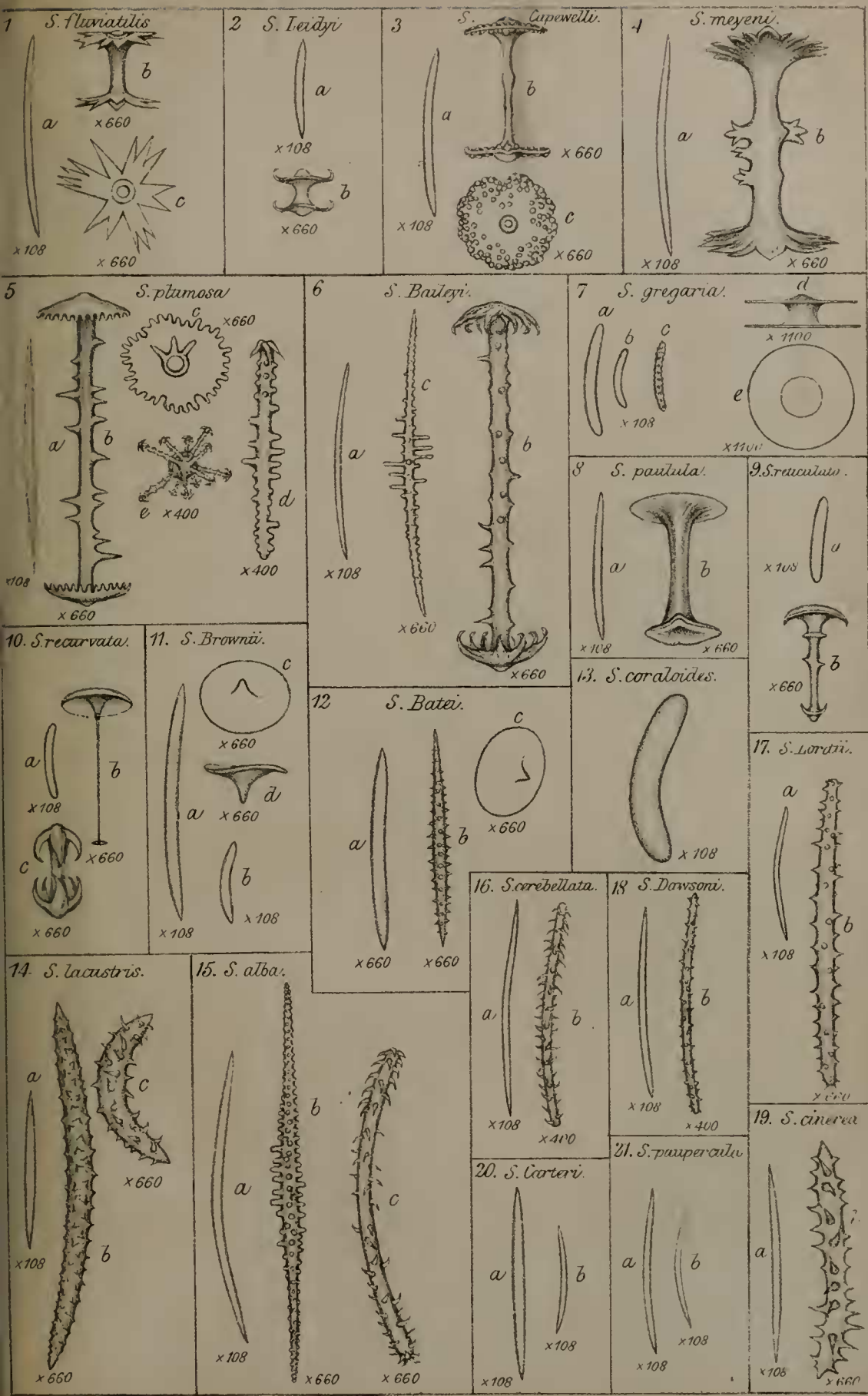
The following papers were read:—

1. A Monograph of the Spongillidæ. By J. S. Bowerbank, LL.D., F.R.S., L.S., Z.S., etc.

(Plate XXXVIII.)

Much uncertainty appears to have existed among our early writers on natural history regarding the number of our native species of *Spongilla*. Ray (Syn. Stirp. 30) notices two species under the designation of "*Spongia ramosa fluviatilis*" and "*Spongia fluviatilis ramosa fragilis*." Charles Stewart, of Edinburgh, in his 'Elements of Natural History' (vol. ii. p. 420, published in 1802), describes one species in the following terms:—"*Spongia lacustris*. Creeping on other bodies and taking their figure, brittle, with erect, round, obtuse branches. Inhabits England, Sweden, &c. This species is found in lakes and rivers; it has a strong peculiar smell; when young, flat; when old, putting forth branches. In autumn it contains little globules, like seeds, which explode when put into the flame of a candle."

Fleming, in his 'History of British Animals' (p. 524, published in 1828), describes two species under the generic designation of *Halichondria*:—"*H. fluviatilis*. Soft, brittle, and slenderly fibrous when dry; spicula linear and doubly pointed. *H. lacustris*. Hard,




L. Aldous del. et lith.

W. West imp

Spongillæ

brittle, and coarsely fibrous; spicula linear and doubly pointed." Dr. Johnston, in his 'History of British Sponges and Lithophytes' (published in 1842), adopts the two species established in Fleming's work, but restores them to Lamarck's genus *Spongilla*.

Dr. Fleming was perfectly right in referring the British Spongillas to the genus *Halichondria* as then constituted, as in the anatomical structure of their skeletons they do not differ in any respect from a very considerable number of British Sponges which were then included in that genus, but which I have now found it necessary to arrange separately in the genus *Isodictya*, with which genus, as far as regards the peculiarities of the structure of the skeleton, they are still identical; but they differ from it materially in their reproductive organs. In *Isodictya* the mode of reproduction is by internal gemmulation, while in *Spongilla* the same vital function is always exercised through the medium of ovaria; and in these organs a peculiar structure and class of spicula prevail, which are never found in the reproductive organs of any of the species of the marine genus *Isodictya*. Their marked difference from that genus in so important a function, and the striking and constant peculiarities of the organs appropriated to that purpose, fully warrant their being retained as a distinct genus under Lamarck's designation of *Spongilla*, in accordance with the opinions expressed by that author, as published in the second edition of his 'Histoire Naturelle des Animaux sans Vertèbres' (vol. ii. p. 111). But the description of the genus, as there given, does not appear to me to be sufficiently definite, and I have therefore endeavoured to amend it in the third part of my paper on the "Anatomy and Physiology of the *Spongiadæ*," published in the second part of the 'Philosophical Transactions of the Royal Society' for 1862, p. 1115, as follows:—

"Spongilla, Linnæus, Lamarck, and Johnston.

*Halichondria*, Fleming.

"Skeleton without fibre, composed of a symmetrical network of spicula; the primary lines of the skeleton passing from the base or centre to the surface, and the secondary lines disposed at about right angles to the primary ones. Reproductive organs ovaries, coriaceous, abundantly spiculous."

Although Dr. Johnston adopted the two British species as described by Dr. Fleming, he still retained doubts as to their being in reality more than one; and it was not until I had made careful microscopical examinations of the ovaria of each that their distinctive specific characters were determined to my own satisfaction.

If we partially dissolve these organs in hot nitric acid, we find the spicula of the walls of the ovaries of *S. fluviatilis* consisting of birotulate forms, having their axes disposed at right angles to the surface; while the spicula of the ovaries of *S. lacustris* are simple and elongate, and are disposed parallel to the surfaces of those organs, thus affording occult but certain distinctive characters, without which, from the great similarity in their habits and skeleton-structures,

it has hitherto been very difficult to distinguish one species from the other.

These peculiarities in the structure of the ovaria of the two species have a more extended value than that of merely serving to establish a specific difference, inasmuch as the subsequent examination of the different species of *Spongilla* that have come into my possession has convinced me that *S. fluviatilis* and *S. lacustris* may through their aid be considered as the types of two well-defined groups, which are distinguished by modifications of these peculiarities in the structure of each of their ovaria.

The two British Spongillas appear to have long since been found, and described under various names, in several parts of the continent of Europe; but no other species were known to naturalists until, in 1849, Mr. Carter named and described five new ones in his "Descriptive Account of Freshwater Sponges in the Island of Bombay," published in the 'Transactions of the Bombay Branch of the Royal Asiatic Society' (No. 12, 1849); and one other species I received from my friend Mr. Dean, of Clapham; it was brought by Dr. Bradley from the freshwater tanks near Aurungabad, in the dominions of the Nizam, thus making six from the East Indies. The whole of these agree, in their general habits and in the fragility and delicacy of their structure when dried, with our British species *S. fluviatilis* and *S. lacustris*. I am much indebted to Mr. Carter for his kindness and liberality in presenting me with specimens of the species he has so ably investigated and described, by which I have been enabled to compare them carefully with our European ones; and to one or the other of the two groups represented by these species the whole of the East Indian ones may be referred.

During the course of my examinations of the East Indian species, I received two consignments of Spongillas from the River Amazon, collected by Mr. Bates, the indefatigable and talented investigator of the natural history of those interesting regions. In these two collections I have been able to distinguish as many as six new species; to which may be added a seventh from the River Winguay, a tributary to the Amazon, presented to the Royal College of Surgeons by W. Bragge, Esq. The greater portion of these species differ widely in their general habits from the European and East Indian ones, being exceedingly strong and rigid in their dried condition, and the reticulations of their skeletons are very much stouter and stronger; but although thus differing, the whole of them may be referred to the group represented by our British species *S. fluviatilis*, having the ovaria furnished with birotulate or scutulate spicula.

In the seven species which I have described from the River Amazon there is an amount of variation in the forms and proportions of the birotulate spicula that renders these organs peculiarly valuable as distinctive characters. Thus, in *S. Meyeni* the birotulate forms do not differ very much from those of *S. fluviatilis*, but their proportions are three or four times as great as in that species. In *S. plumosa* the size of the rotulæ very little exceed those of *S. fluviatilis*, but the length of the spicula are at least five times that of the

British type of the group. In *S. paulula* there is a tendency in the proximal rotulæ of the spicula of the ovaries to become obsolete, few of them exceeding half the diameter of the distal rotulæ. In *S. reticulata* the proximal rotulæ are still less in their proportions; and in *S. recurvata* this part of the spiculum is represented by a slight spherical head, like that of a common pin. In *S. Brownii* and *S. Batesi* the shaft as well as the proximal end of the birotulate spiculum becomes entirely obsolete, and we have one rotula only left; the birotulate spiculum being thus represented by the scutulate forms of those species.

I have received five species from North America, including one from Vancouver's Island. The whole of these resemble, in their habits and in the fragility of their structures, the East Indian and British species. Two of them belong to the rotulate group, and three to the elongo-spiculate one. These five, I apprehend, are but a small portion of the number of species that we may expect to find in the lakes and rivers of North America.

In a letter from the late Professor Bailey, of West Point, New York, in reply to my inquiries regarding the *Spongillidæ* of America, he writes, "I have been greatly disappointed by not finding any specimens of American *Spongilla*. I felt quite sure that I had a large piece, which I gathered in Lake Monroe, Florida, having abundance of gemmules; but the most careful search among my Florida gatherings fails to bring it to light. It must have been a portion of this which I sent to Mr. Marshall; perhaps I sent him the whole, although that is not my usual custom. I send a specimen of the mud of a creek in Florida, containing spicules and *Amphidisci* from the same species as that above referred to. The Florida *Spongilla* grew abundantly on the submerged roots of the deciduous Cypress. I ought to have collected fine specimens of *Spongilla* in Maine two years ago. The river in which I looked daily, when there, abounded in *Spongilla*, which covered logs, roots, stems, &c., with masses often of several feet in extent. It generally was in a layer of from about a quarter to half an inch in thickness, of a fine *Oscillatoria*-green colour, and occasionally rising into finger-like processes of several inches in length.

"The *Spongilla* of the small lakes in this vicinity rarely forms very large masses. I have found it in layers on the undersides of stones in moderately deep water, and have also seen finger-like masses in shallow water."

In the dust from the box containing the fragments of *Spongilla* from the water-pipes of Boston, sent to me by Dr. Asa Gray, there were spicula which indicate the existence of two or three other species in the waters that supply the inhabitants of Boston. One is an acerate spiculum, as large as a full-grown one, from the skeleton of the *Spongilla* from the water-pipes, *S. paupercula*, but not smooth like that spiculum; on the contrary, it is abundantly furnished with incipient spines, which cover all parts of the shaft, excepting near the apices, where it is smooth for the space of about twice the largest diameter of the shaft. *Spongilla cinerea*, Carter, from

Bombay, has the skeleton-spicula incipiently spinous, but I have not hitherto found the same character in any of the North American species. These spinous spicula apparently represent a species at present unknown to us. Beside the spinous spiculum described above, there are two other forms, neither of which are above one-fifth or one-sixth the length of the skeleton-spiculum of *S. paupercula*; and both have every character of being tension-spicula, or those belonging to the interstitial and dermal membranes of some species of *Spongilla*. One of these is cylindrical, straight, short, and stout, with hemispherical apices, and is covered all over with incipient spines, which requires a linear power of about 300 to define them well. The other is of about the same length as the one last described, but of a fusiformi-acerate shape, is very slender, and requires a power of about 700 linear to define it well. It is entirely covered with well-produced conical spines, with a few truncated ones near the middle of the shaft. This spiculum is very like that which abounds in the dermal membrane of *Spongilla lacustris*; but it is most probable that it may be an incompletely developed one of *S. baileyi*.

In *Spongilla lacustris* the tension-spicula of the membranes and the dermal spicula of the ovaria differ in form. The former are fusiformi-acerate, covered with spines; the latter cylindrical and very much curved; so that, judging from these circumstances, it may ultimately prove that the two small forms of spicula from the dust accompanying *S. paupercula* may belong to the same sponge, or it may be that they indicate the existence of two distinct species. In the latter case, there are evidently three distinct species of *Spongilla* in the sources of the Boston water beside the one prevailing in the water-pipes.

At the time I received the specimen of *Spongilla* from Professor Bailey to which I subsequently attached his name, he very kindly sent me a small packet of infusorial earth, very rich in the spicula of the *Spongillidæ*, "from Duval's Creek, near Lake Monroe, St. John's River, Florida." I have examined this material carefully, with the view of forming an approximate estimate of the number of species of *Spongilla* existing in the waters whence it came; and the following are the results. I found the birotulate spicula of the ovaria of *S. Baileyi* in moderate abundance, but I did not recognize those of the membranes. A second form of birotulate spiculum, with a strongly spiculated shaft, occurred in abundance. This spiculum is very like those of the ovaries of *S. Meyeni*, Carter, from the water-tanks of Bombay, and could not by its form alone be separated from those of that species. Beside these there are a considerable variety in size and form of smooth spicula, which have every appearance of being skeleton-ones; so that the number and variety of these justify the idea, eliminated by the number and variety of tension-spicula of unknown species, that there are at least five or six North American species of *Spongilla* beside those with which I am already acquainted.

The Australian species *S. Capewelli* is an interesting addition to

our knowledge, and indicates a very extensive range for the genus. And not the least remarkable point in its history is its very close approximation in habit and structure to our British species *S. fluviatilis*. During my examination of the Australian specimen, I met with two spicula of the same form, entirely spined, cylindrical, which do not belong to *S. Capewelli*, and which are probably tension-spicula, or spicula of the ovaria, of a second species existing in Lake Hindmarsh.

Spongilla fluviatilis, Johnston.

Sponge massive, sessile; surface uneven, often lobular, hispid. Oscula simple, large, scattered. Pores conspicuous. Dermal membrane pellucid, aspiculous. Skeleton-spicula acerate. Ovaria subglobose; spicula birotulate, short, rarely spinous; disposed in lines radiating from the centre of the ovarium; rotulæ equal in size, flat, deeply and irregularly dentate, diameter equal to the length of the shaft of the spiculum.

Colour, alive, yellow or green.

*Hab.* Rivers and lakes of Europe.

Examined alive.

Dr. Johnston, in his 'History of British Sponges,' has given so able a digest of all that has been written regarding this species and its numerous changes of name, both generic and specific, as to render any observations on that part of my subject a work of supererogation.

The normal form of this species is certainly massive and sessile; and the arborescent form that it is said to occasionally assume is due to its having originally been parasitical on stems of plants, and perhaps also not unfrequently to *S. lacustris* having been mistaken for this species. When developed under favourable circumstances, I have seen large rounded lobes projected from its surface; but I have never seen it assume an arborescent form like that of *S. lacustris*.

The absence of spicula in the dermal membrane of this species readily distinguishes it from *S. lacustris*; but the most striking differential character exists in the birotulate spicula of the ovaria, the correct form and position of which were, I believe, first pointed out by Meyen in Valentin's 'Repertorium,' 1840.

The shaft of the spiculum is usually smallest at the middle, and it increases more or less as it approaches the rotulæ; and occasionally, but rarely, we find a single large spine projecting at right angles from near its middle. The rotulæ are flat and deeply and irregularly divided, the divisions frequently extending from the circumference to very near the centre. They are disposed very closely together in the walls of the ovaria, the outer rotula supporting the external membrane, and the inner one performing the same office for the internal membrane; but they are so completely covered by the respective membranes, that without the application of nitric acid they would be extremely likely to escape observation.

Spongilla Leidii, Bowerbank.

Sponge sessile, coating thin; surface tuberculated, minutely hispid.

Oscula numerous, small, congregated, elevated, and marginated. Pores conspicuous. Skeleton-spicula acerate, small, short, and stout, rather obtusely terminated. Dermal and interstitial membranes pellucid, aspiculous. Ovaria spherical, small; dermal spicula birotulate, minute, short; shaft cylindrical; rotulæ, margins entire, that of the outer one sometimes exflected, and rarely spiculated.

Colour yellow, with a tint of green.

*Hab.* Schuylkill River, United States (*Dr. J. Leidy*).

Examined in the dried state.

I am indebted to my friend Prof. Leidy of Philadelphia for a specimen of this species, $3\frac{1}{2}$ inches long, $2\frac{3}{4}$ inches wide, and $\frac{1}{8}$th of an inch in thickness. The whole of the upper surface is thickly and rather uniformly studded with variously shaped elevations, none of which exceed about a line in height; and each one has on its summit one or more oscula, and frequently as many as five or six, the whole being enclosed within a slightly raised, thin margin. The oscula are exceedingly numerous, but very minute. The pores are readily to be distinguished by the aid of a lens of 2 inches focus. The whole surface of the sponge is minutely hispid from the projection of the terminal spicula of the primary lines of the skeleton-tissue.

The spicula of the skeleton are short and stout; an average-sized one measured $\frac{1}{150}$ inch in length, and had a diameter of $\frac{1}{2000}$ inch. I could not detect any tension-spicula in either the dermal or interstitial membranes.

The ovaria are rather abundant at the basal surface of the sponge; they are very small, and are scarcely visible to the unassisted eye. In the dried state they are nearly all of them more or less hemispherical by contraction, but their normal form is spherical. In the adult state they are furnished with a closely packed stratum of birotulate spicula. They are very minute, an adult one measuring $\frac{1}{2143}$ inch in length, the diameter of the rotulæ being $\frac{1}{1500}$ inch, and the diameter of the shaft $\frac{1}{7500}$ inch. They are not visible, excepting by previous preparation in boiling nitric acid. The margins of the rotulæ are very entire, and in fully developed spicula that of the outer one is frequently exflected; but I did not observe this character to occur in any of the proximal ones. In a very few instances the shaft of the spiculum was continued through the centre of the distal rotula, forming an acutely terminated central spike.

When a section at right angles to the dermal surface of the sponge was examined, two distinct layers of growth were visible, the first dermal membrane remaining in the midst of the sponge. From this circumstance it appears probable that the species is perennial, and, from the last stratum being in perfect accordance with the first, that its natural character is that of a thin coating sponge, never rising in the form of tuberous masses like the closely allied European species, *S. fluviatilis*.

The specific names *friabilis* and *fragilis* have been applied so loosely and indefinitely to the European species that I do not think it advisable to adopt the latter, which was appended to the specimen

sent to me; and as I am not aware that the species has been described and published before, I beg to dedicate it to my friend Dr. J. Leidy, who has worked so well and worthily for the advancement of science, and to whom I am indebted for my knowledge of the species.

Spongilla Capewelli, Bowerbank.

Sponge massive, sessile; surface uneven, often lobular, smooth. Oscula simple, minute, dispersed. Pores inconspicuous. Dermal membrane pellucid, aspiculous. Skeleton-spicula acerate, rather short and stout. Ovaria subglobose; spicula birotulate, rather long, disposed in lines radiating from the centre of the ovary; rotulæ flat, margins slightly and irregularly crenulate; shafts slender, incipiently spinous, varying in length from one to one and half diameter of a rotula.

Colour dull green, with a tint of yellow.

*Hab.* Lake Hindmarsh, Victoria, Australia; lat. 35° 30′ S., long. 141° 40′ E. (*L. P. Capewell, Esq.*).

Examined in the dried state.

We are indebted to the energy and enterprise of Mr. Capewell for the knowledge of the existence of *Spongilla* in the freshwater lakes of Australia. The specimen, the type of the above description, is $7\frac{1}{2}$ inches long and 3 inches in its greatest diameter, surrounding in a very irregular manner a small twig of wood, not $\frac{1}{4}$ of an inch in diameter, and from which it projects in large tuberiform masses. Mr. Capewell states in his letter to me that "the manner in which it is found is, lying upon the shores. In the winter season, about June, the weather being very tempestuous, the lake becomes greatly agitated, and the roll and swell is so great that at times a small boat could scarcely live upon the surface. It is after one of these storms that, by searching along the shores, you may obtain specimens. I have searched well for it among the reeds and upon the branches of trees pendant in the water, but did not succeed in finding them in those situations, and my impression has always been that it coated dead branches of trees that have fallen some depth in the water.

"The colour and appearance of the specimens when found is exactly the same as the dried specimen would have if dipped in water."

The description of the habit of this *Spongilla* would do equally well for that of our British species *S. fluviatilis*, with which it assimilates in anatomical structure in a very remarkable manner.

The oscula appear to be less in size, but more numerous, than in the British species, and the skeleton less fragile. The skeleton-spicula are shorter and stouter than those of *S. fluviatilis*, their length being in comparison about as 3 to 4. The ovaria are numerous; they are situated on the basal membrane in a single, closely packed stratum, and do not appear dispersed in the substance of the deeply seated portions of the sponge as in *S. fluviatilis*. In their size and general appearance they very closely resemble those of the British species. Externally they are supplied with numerous short, curved,

acerate spicula, which are irregularly dispersed on their surfaces. The birotulate spicula of the ovaria, compared with those of *S. fluviatilis*, present the most decided differential characters. The rotulæ, instead of being deeply incised at their margins, are only slightly crenulate; and their shafts, although longer in proportion than those of the British species, are scarcely half their diameter, and nearly all of them are incipiently spinous. Thus, notwithstanding their general similarity in form, these differences in structure at once establish the distinct specific character of this sponge.

Spongilla Meyeni, Carter.

Sponge massive, sessile; surface tuberculous, hispid. Oscula scattered, mostly intertuberculous. Pores conspicuous. Dermal membrane aspiculous, thin, and translucent. Skeleton-spicula acerate, stout, incipiently spinous. Ovaria subglobular; spicula birotulate, disposed in lines radiating from the centre of the gemmule; rotulæ flat, irregularly but deeply dentate, divisions frequently extending to near the axis; shaft from once to twice the length of the diameter of the rotulæ, cylindrical, without spines or with from one to three or four near its middle.

Colour yellow.

*Hab.* Freshwater tanks, Bombay (*Carter*).

Examined in the dried state.

I have received four specimens of this species from Mr. Carter. The surface of all of them is profusely furnished with large tuberculous projections; on two of them these masses are rounded evenly, and terminate nearly hemispherically; while in the other two they are more attenuated, furrowed longitudinally, and are rather sharply terminated. These varieties of form are evidently the effect of differences in locality only, as in all their organic characters they are in perfect accordance.

There is a remarkable coincidence in the organic characters of this species and our European *S. fluviatilis*. The indistinct mode of the arrangement of the skeleton, the form of the spicula of which it is composed, the form of the ovaria and of their spicula are as nearly as possible the same; and it is only when we examine not only the forms but the proportions of these organs, that we perceive that there are really sufficient organic differences to constitute them distinct species.

The variation in the spicula of the skeleton is not very great, those of *S. Meyeni* being $\frac{1}{61}$ inch in length, while those of *S. fluviatilis* are but $\frac{1}{75}$ inch long. In the characteristic spicula of the ovaries it is that the greatest discrepancy exists. In *S. fluviatilis* they are remarkably constant in their proportions, being $\frac{1}{1214}$ inch in length; and the rotulæ are as near as possible equal in diameter to the length of the spiculum: the rule is, that the shaft should be without spines; and the occurrence of a single spine near its centre is the exception, and this occurs in about the proportion of one to twenty or thirty smooth spines; while, on the contrary, in *S. Meyeni* the rule is the presence of from one to four or five spines on the shaft, and the ex-

ception their absence, one in every three or four being without them; and the size of the spicula is exceedingly variable, ranging from $\frac{1}{843}$ inch long and broad to $\frac{1}{500}$ inch long by $\frac{1}{1000}$ inch broad. In other respects the spicula in both species are remarkably similar in their characters. If we have recourse to the less constant but (in this case) valuable characters of form and colour, we can scarcely mistake the species, as the dissimilarity in those respects are strikingly marked.

The measurements given by Mr. Carter of those organs, in his valuable paper, are as nearly in accordance with those I have made as they can be expected to be in such a case.

I have been unable to find any "amorphous siliceous deposit" cementing the spicula of the gemmules together, and a few minutes' boiling in nitric acid effects a complete separation of them from the animal tissues in which they are imbedded.

I do not think it probable that the species examined by Meyen was the one that has been named after him, but rather that it was our European species *Spongilla fluviatilis*, with the structure of which Mr. Carter (from his residence in India at the time of writing his paper) was not acquainted.

Spongilla plumosa, Carter.

Sponge sessile, massive or subramose; surface hispid. Oscula dispersed, numerous. Pores inconspicuous. Dermal and interstitial membranes aspiculous. Skeleton-spicula fusiformi-acerate, stout. Ovaries semiovoid; spicula birotulate, disposed in lines radiating from the centre of the ovary; shaft three to four diameters of the rotulæ in length, cylindrical, abundantly spinous; rotulæ externally convex, internally concave, margins irregularly dentate. Sarcode: spicula subsphero-stellate, multiradiate; radii spinous; apices pileate or capitulate.

Colour yellow or green.

*Hab.* Freshwater tanks, Bombay (*Carter*).

Examined in the dried state.

I have received three specimens from Mr. Carter of this distinct and well-characterized species: two of them are portions of larger Sponges, they are both yellow and massive, having the upper surface of each with very slightly elevated portions, but exhibiting no ramose projections; while the third specimen, rather exceeding 4 inches in diameter, is entirely composed of short branches of a bright-green colour, ramifying from a common base. It is therefore apparent that there is a considerable latitude in form and colour in this species; and in truth the difference in these respects is so great between the last and the first two specimens that a superficial examiner would undoubtedly designate them as distinct species; while in their organic structures there is no preceptible difference.

An average-sized spiculum of the skeleton measured $\frac{1}{64}$ inch long and $\frac{1}{136}$ inch greatest diameter.

The greater portion of the ovaries are semiovoid in form; a few

of them are subglobose; but the most striking specific character exists in the birotulate spicula of these organs, which vary remarkably in form and proportion from those of any known Indian species of *Spongilla*. While those of *S. Meyeni* rarely exceed two diameters of the rotulæ in length, in *S. plumosa* they nearly all range from three to three and a half diameters long. The shaft is equably cylindrical throughout its whole length, and is abundantly furnished with stout spines, frequently exceeding the diameter of the shaft in length. The rotulæ also are essentially different from those of either *S. fluviatilis* or *S. Meyeni*: in those species they are thin, flat on both sides, and irregularly and deeply dentate, the divisions reaching very nearly to the centre of the rotulæ; while in this species the rotulæ are internally concave and considerably and regularly convex on the outer surface, having the circumference only slightly dentate in comparison with the species above named, and, whether *in situ* after preparation in nitric acid, or in a state of separation, they are perhaps the most beautiful form of sponge-spiculum with which we are acquainted.

The occurrence of subsphero-stellate spicula in the sarcode of this species is a remarkable fact, as they have not hitherto been found in any species of the genus; nor are they frequently found among the marine *Spongiadæ*. They occur in the sarcode of *Tethea lyncurium*, but the radii are acutely terminated and are without spines. In *Pachymatisma Johnstonia* they abound in the sarcode, with very short incipient spines on the radii; and in *Geodia carinata*, from the South Pacific Ocean, Bowerbank MS., I obtained one spiculum in which the rays are profusely spined. In *Dactylocalyx pumicea*, Stutchbury, multiradiate spicula are found, the radii of which have either acute or depressed capitulate terminations, but without spines; and it is only from *Spongilla plumosa* that I have observed them to have pileate or capitulate terminations and have the radii at the same time strongly spined. The subsphero-stellate spicula are exceedingly variable in the mode of their development: sometimes there is one comparatively large straight fusiform spiculum, pileate at one or both ends, and one or more slightly developed rays dispersed near the middle of it, also more or less pileated; but the general form is a series of rays of nearly equal length radiating from an irregularly formed common centre, having a few recurved spines on the shaft, and a closely packed cluster of recurved spines at the apex, which take the shape of a little cap closely resembling a young mushroom in form; but when not fully developed, they assume the appearance of an irregular capitulum. Occasionally, but not very frequently, they terminate acutely. The extreme diameter of a well-developed cluster of radii is about $\frac{1}{500}$ inch.

These beautiful spicula are not mentioned in the specific description of this Sponge by Mr. Carter; but he subsequently observed them and mentioned them in a letter to me in the latter part of 1854.

That author in his paper observes, "I have only found three or four specimens of it (*S. plumosa*), and these only in two tanks. I have never seen it fixed on any body, but always floating on the sur-

face of the water about a month after the first heavy rains of the S.W. monsoon have fallen."

Spongilla Baileyi, Bowerbank.

Sponge coating; surface smooth? Oscula and pores inconspicuous. Dermal membrane spiculous; spicula fusiformi-acerate, entirely spined; spines of the middle cylindrical, truncated, very long and large. Skeleton-spicula subfusiformi-acerate, rather slender. Interstitial membranes spiculous; spicula same as those of the dermal membrane. Ovaria globular, smooth, abundantly spiculous; spicula arranged in lines radiating from the centre to the circumference of the ovary, birotulate; rotulæ irregularly and deeply cleft at the margins, incurvate; shaft very long, cylindrical, entirely spined; spines conical.

Colour, in the dried state, dark green.

*Hab.* A stream on Canterbury Road, West Point, New York (*Prof. J. W. Bailey*).

Examined in the dried state.

I am indebted to the late Prof. Bailey, of West Point, New York, for my knowledge of this interesting species. In a letter to me, dated 30th Nov. 1856, he writes, "The only bit of *Spongilla* I have been able to find in my collection is from a small mountain-stream near West Point. It was picked from a small pebble in a pool which the stream formed as it crossed the road. It attracted my attention, I believe, as being of very small size to have gemmules. I send it just as it was gathered."

The specimen was in an oblong packet less than an inch in length; it contained a few fragments of *Spongilla*, the largest of which was about two lines in diameter. It was full of gemmules, and in fine condition for examination.

The structural peculiarities of this Sponge are very remarkable; it belongs to the tribe of which all have birotulate spicula imbedded in the coat of the ovarium and disposed in lines radiating from the centre to its circumference. It has the birotulate spicula four or five times as long in their proportions as those of the ovaria of *S. fluviatilis*. Its nearest congener is the East Indian species *Spongilla plumosa*, Carter; but it differs in structure from that Sponge, both as regards the tension-spicula and those of the ovaria, the rotulæ in *Spongilla Baileyi* being cleft or dentated to very near the centre, while those of *S. plumosa* are entire, excepting a slight marginal crenation, and the shaft also is considerably shorter than in those of *S. baileyi* when fully developed.

I observed these beautiful spicula in every stage of development, from the slender smooth shaft with only slightly clubbed terminations to the abundantly spinous shaft and fully produced rotulæ, just as those of *S. plumosa* are represented in pl. 26. figs. 18–20, in the 'Phil. Trans.' of the Royal Society of London for 1858.

The tension-spicula of the dermal and interstitial membranes are remarkably characteristic. They are very small, and require a power of about 700 linear to define them well. They are very similar to

the corresponding spicula in *Spongilla alba*, Carter, from the water-tanks of Bombay; but the truncated cylindrical spines are longer than in that species. In *S. Baileyi*, near the middle of the spiculum, they often equal and sometimes exceed in length its greatest diameter. Fig. 22, pl. 24, 'Phil. Trans. London' as above quoted, serves well to represent the general character of these spicula.

I have much pleasure in dedicating this interesting species to the memory of one who has done so much, and in so able a manner, to develope the microscopical natural history of his country, and who was ever ready to assist his brother naturalists in any quarter of the globe, either with material for examination or with information from his rich stores of knowledge.

SPONGILLA GREGARIA, Bowerbank.

Skeleton-spicula cylindrical, stout, and rather short. Ovaria furnished with an envelope; spicula of the envelope few and scattered, cylindrical, short and stout, entirely spined. Ovaria, surface even, furnished abundantly with very short birotulate spicula; rotulæ flat, margins entire, outer surface umbonate; umbo very short, slightly convex. Shaft of spiculum cylindrical, short, and stout.

Colour, dried state, dark lurid green.

*Hab.* River Amazon, on branches of trees periodically pendent in the water, near Villa Nova.

Examined in the dried state.

All that I have yet seen of this species consists of small patches of ovaria, varying from $\frac{1}{8}$th to $\frac{3}{16}$ths of an inch in diameter, of a single layer of ovaries partially surrounding the small branches of trees pendent in the water of the River Amazon at certain seasons of the year. These little patches of ovaria look very like groups of the eggs of flies the larvæ of which are aquatic, and which are so frequently to be seen on the small stems and branches at the margin of ponds and rivers. On examining them with a Lieberkuhn, and power of one hundred linear, it was at once apparent that they were not ovaria of the *Spongilla* that occupied the greater part of the stem on which they were seated—*S. reticulata*. I therefore proceeded to a regular examination of them, and soon satisfied myself that they belonged to an entirely new species, with the mass of the Sponge of which I am still unacquainted; but from the well-marked characters to be derived from their structure and the small portion of the skeleton connecting them together, I have been enabled to give a provisional description that will serve to give a standing to the species until a better acquaintance with the entire Sponge allows us to complete the characters.

The spicula of the skeleton are cylindrical and smooth, and very little larger than those of the envelope of the ovaries. They vary somewhat in size, and occasionally the rudiment of a spine or two may be detected upon them; but this may perhaps be induced by their being so closely connected with the envelope of the gemmule, and occurring only in the short cylindrical portions of skeleton connecting the gemmules together; and I am the more inclined to this

opinion as I observed a few of the profusely spiniferous spicula of the envelope intermixed with the proper smooth spicula in the short lengths of skeleton separating the ovaria. The spicula of the envelope of the ovary are also cylindrical in form; but they are rather shorter and stouter in their proportions than those of the skeleton, and occasionally evince a slight inclination to be subfusiform, and they vary considerably in size. They are slightly curved, and abundantly spiniferous, more especially on the outer curved surface and towards the middle of the shaft of the spiculum. They are dispersed very irregularly over the envelope; and many of them are nearly completely immersed in its strong, coriaceous, cream-coloured substance; but none of them are visible on its inner surface, which appeared quite smooth. The wall of the ovary is much thinner than that of the envelope, and is apparently very little thicker than the length of the short birotulate spicula, which are closely packed in a single layer in all parts of its substance. The spicula of the wall of the ovary are very beautiful objects. The rotulæ consist of two thin flat plates of equal size, with entire margins, connected by a very short, thick, smooth, cylindrical shaft, a slight protrusion of each end of which through the centre of each rotula forms a very short convex umbo on the centre of each outer surface. They are very small; an average-sized one measured, length of spiculum $\frac{1}{3000}$ inch, diameter of rotula $\frac{1}{1538}$ inch, length of the shaft within the rotula $\frac{1}{6838}$ inch.

The gregarious habit of these curious ovaries is very interesting, and the manner in which they are based on the surface of the bark of the plant is very suggestive of the habit. They are not closely adherent by the surface of the envelope, but are supported by a single series of skeleton-spicula, disposed at various angles like a crowd of small props, one end of each spiculum being based on the epidermis of the plant, while the other impinges on the surface of the envelope, the whole being strongly bound together by the horny structure of the skeleton; and short lengths of skeleton-fibre are thrown out laterally, by which the ovaria are connected with each other. It would therefore appear that, as soon as the locality has been selected, the adherent envelope of each ovary generates a single series of spicula to support it above the surface of the plant, so as to allow of a free circulation of water around it during the period of its immersion, and that afterwards they remain dormant in this condition until the next season of immersion in the water, as all these little groups were in precisely the same stage of development; and they were by no means few in number. On one small twig which passed through a specimen of *S. reticulata* 5 inches in length, and extended 4 inches beyond its termination, there were no less than six of these small colonies, varying from three to twenty-six in number, although the branch did not exceed one-eighth of an inch in diameter at any part.

Spongilla paulula, Bowerbank.

Sponge sessile, coating surface rugged, spinous. Oscula simple,

minute, dispersed. Pores inconspicuous. Dermal membrane obsolete. Skeleton-spicula subfusiformi-acerate. Ovaria globose; surface even, slightly pitted; enveloping spicula few, scattered, fusiformi-acerate, entirely spined; spines minute, conical; spicula of the walls inequi-birotulate; rotulæ radially lineated, margins entire, shaft cylindrical.

Colour, dried state, light brown.

*Hab.* River Amazon, on leaves or branches of trees, occasionally pendent in the water. Near Villa Nova.

Examined in the dried state.

This singularly insignificant little species, as it appears from the only specimen I have yet seen, forms a light-brown incrustation, about three-fourths of an inch long, a quarter of an inch wide, and not exceeding half a line in thickness, on a small leaf from one of the stems on which a *Spongilla reticulata* from the River Amazon was seated. It is firmly attached to the leaf by a comparatively stout pellucid basal membrane. It is very irregular and rugged in its structure, throwing up from its base short, stout, conical masses of spicula terminating acutely and giving a strongly spinous and uneven appearance to the distal surface. I examined the Sponge through this surface, both as an opake and a transparent object, with a power of 160 linear, in search of ovaria, but in vain; but on reversing one of the fragments removed from the leaf, I succeeded in detecting a few very minute immature ovaries closely seated on the inner surface of the basal membrane, and completely buried beneath the reticulations of the skeleton. On examining these by nitric acid, I found that none of the spicula of the walls of the ovarium that might be expected to be present were developed; but a renewed investigation of the whole of the fragments I possessed produced one adult ovary, $\frac{1}{60}$ of an inch in diameter, which I succeeded in isolating and preparing successfully for observation. On immersion in water, and when fully expanded, it appeared of a light cream-colour, with an even but slightly pitted surface, to which a few fusiformi-acerate spicula, very much less than those of the skeleton, and very variable in size, were adherent. After careful preparation of the gemmule in nitric acid, these spicula were found to be entirely spined, but the spines are so minute as to require a power of 660 linear to exhibit them in a satisfactory manner. An average-sized spiculum of this description measured, length $\frac{1}{300}$ inch, greatest diameter $\frac{1}{526}$ inch. The walls of the ovary were filled with stout inequi-birotulate spicula $\frac{1}{737}$ inch in length; the larger rotula measured $\frac{1}{1052}$ inch in diameter, and the smaller one $\frac{1}{1596}$ inch in diameter. The shaft is cylindrical, expanding slightly towards each end; the diameter at the middle was $\frac{1}{6000}$ inch. The central canal in the shaft is unusually and strikingly visible; and at its terminations in the rotulæ it throws off numerous minute radiating branches, extending from the centre to the circumference of those parts of the spiculum, giving to them, when viewed with a linear power of 660, a radially lineated appearance. In one of the large rotulæ I counted nineteen of these minute canals.

An average-sized spiculum of the skeleton measured, length $\frac{1}{100}$ inch, greatest diameter $\frac{1}{1639}$ inch.

SPONGILLA RETICULATA, Bowerbank.

Sponge massive, sessile; surface spiniferous, interspaces closed by a coarse reticulation of spicula. Oscula, pores, and dermal membrane obsolete. Skeleton-spicula subfusiformi-cylindrical, short, and stout. Ovaria spiculous, encased in an oval, irregular, and coarse reticulate envelope of spicula; surface of envelope even. Spicula of envelope cylindrical, slightly curved, entirely spined, short, and stout. Ovaria oviform, thin; surface smooth; foramen tubular: spicula boletiform; large internal extremity, externally convex, internally concave, margin entire; small external extremity, clavate, sometimes stellate; shaft more or less attenuating from each end towards the middle, furnished irregularly with a few conical spines.

Colour, dry state, dark green, with a brown tint.

*Hab.* River Amazon, on pendent branches of trees.

Examined in the dried state.

I received nine fine specimens of this interesting species from Mr. Bates. The label accompanying them states that they were from "Dark Ygapos in virgin forest, margins of Amazon, Villa Nova (when the waters have receded, found clinging to the trees), Nov. 20, 1854." The largest specimen surrounds a curved branch of a quarter of an inch thick. The Sponge is fusiform, 9 inches in length, and 2 inches at the greatest diameter in thickness; the surface is irregularly tubercular. The other specimens vary considerably in form, following the direction of the branches, which they surround completely, although frequently not more than the eighth of an inch in thickness; and of the very young specimens, four of which occur on different branches of the same stem, one, although not more than half an inch long, has already succeeded in entirely embracing the stem.

The superficial interspaces are closed by a coarse rigid network of spicula. Through this the terminations of the primary fibres of the skeleton are projected a line or more in length, forming stout conical spines all over the surface. The internal interspaces are also more or less filled with a similar network to that which closes the superficial ones.

The spicula of the skeleton are short, stout, and cylindrical, with a slight inclination to be fusiform, especially when large and fully developed; the terminations are hemispherical.

The ovaria are abundant in all parts of the Sponge. The envelope is composed of a coarse, irregular network of spicula, the interstices being filled in by membranes thickly coated with sarcode. The spicula are cylindrical, with hemispherical terminations, and they are furnished in all parts with short conical spines. The envelope is sometimes observed attached, by one side, to a large fibre; at other times it is supported in an interspace by two or three short pedicels of spicula. The ovarium fills the interior of the envelope; it is ovi-

form, terminating at the small end in a short, cylindrical, tubular foramen, the length of the tube beyond the outer surface of the ovarium being about equal to its diameter. The foramen appears to be most frequently at the distal end of the envelope as regards its attachment to the skeleton. The thickness of the wall of the ovarium appears to be determined by the length of the boletiform spicula, the outer convex surface of which forms the inner surface of the ovary, while the small clavate or stellate end is seen either immediately beneath the outer surface of the ovary or slightly projecting beyond it. In the living condition it is probable the former would be its natural position.

There are several singular points in the structure of this species. I have never found before among the *Spongillidæ* either the ovary oval or the foramen distinctly projected above its surface; and it is the first occurrence of the singular and beautiful boletiform spicula.

Spongilla recurvata, Bowerbank.

Sponge sessile, coating surface even, smooth. Oscula inconspicuous, numerous, simple, dispersed. Pores inconspicuous. Dermal membrane thin, translucent, aspiculous. Skeleton-spicula cylindrical, short, and stout. Ovaries globose; surface even, pitted, furnished with spicula: external spicula multihamate-birotulate; hami of the rotulæ stout, attenuating, much recurved; shaft cylindrical: internal spicula boletiform; proximal or large extremity irregularly circular, flat, or very slightly convex outwardly, thin, margin entire; small or distal extremity lentiform; shaft attenuating from the larger to the smaller extremity.

Colour, dried state, light brown.

*Hab.* Villa Nova, River Amazon.

Examined in the dried state.

This little species was found closely embracing about half of one of the small stems of a tree, which a full-sized specimen of *Spongilla reticulata* covered for about 6 inches in length; the stem rather exceeded one-eighth of an inch in diameter; and the large Sponge in its growth has evidently partially grown over the smaller one, which is not more than one-third of a line in thickness. The best specimen I possess was detached, and was found loose in the paper in which the whole of the specimens I received from Mr. Bates were packed; it is about three-fourths of an inch in length; and the Sponge when whole, judging from the length of the detached portions, may have been about 3 inches in length. In the largest detached piece there were more than forty ovaria imbedded in one stratum at the base of the Sponge, with the foramen of the greater part of them downwards. The diameter of an average-sized one was $\frac{1}{60}$ inch. We may therefore fairly infer, although the Sponge is so thin, that it is in an adult condition. Notwithstanding its length, it does not appear to be in the habit of entirely surrounding the stem on which it is seated, as it had done so in one small spot only.

The oscula are not visible without the aid of a lens; they are various in size, and rather numerous. The dermal membrane is thin and

translucent, and is supported on a network of spicula; this network of the dermal surface is thick and abounding with spicula; but that of the internal skeleton seldom exceeds two or three spicula in substance, and the size of the interstices are usually determined by the length of the spicula, which vary considerably in size. A fully developed one measured, length $\frac{1}{176}$ inch, greatest diameter $\frac{1}{1579}$ inch.

In the dried condition the ovaries are nearly hemispherical, but when expanded in water they become globose; in this state, when viewed with a power of one hundred linear by the aid of a Lieberkuhn, they are cream-coloured, and present an irregular and deeply pitted surface; and from these indents or pits the multiradiate-birotulate spicula of the outer surface of the ovary are projected at right angles to the surface, very often for nearly the whole of their length. If the ovaries be acted on by boiling nitric acid so as to render it transparent without entirely disintegrating it, we then see the delicate and beautiful boletiform spicula, the large rotulæ of which are placed at the inner surface of the ovarium; while the slender shaft with its small lentiform distal termination is projected, at right angles to the inner surface, through the substance of the wall of the ovary to very nearly its outer surface. This spiculum certainly presents one of the most graceful and elegant forms I have ever seen among sponge-spicula.

The external surfaces of the rotulæ of the birotulate spicula are smooth, very convex, and in many cases almost hemispherical; so that the points of the curved spines are in the direction of planes parallel to the shaft of the spiculum, and the rotula is cleft almost to the point of union with the shaft. The number of spines vary: in one rotula there were as many as ten; but the usual number is about five or six.

The contrast between the two sorts of spicula in the ovary is very great; one is all lightness and delicacy of structure, the other the type of strength and solidity. The latter, the multiradiate-birotulate form, is $\frac{1}{1056}$ inch in length, the diameter of the rotulæ $\frac{1}{1500}$ inch, and the diameter of the shaft $\frac{1}{4286}$ inch. The former or boletiform spicula have the following dimensions:—length $\frac{1}{707}$ inch, diameter of large discal end $\frac{1}{1027}$ inch, and diameter of the middle of the shaft of the spiculum $\frac{1}{25000}$ inch. Lentiform termination $\frac{1}{6000}$ in diameter.

Spongilla Brownii, Bowerbank.

Sponge massive, sessile; surface spiniferous; superficial interspaces open. Oscula, pores, and dermal membrane obsolete. Skeleton-spicula fusiformi-acerate, very stout. Ovaries spherical, spiculous, encased in a globose, irregularly but closely reticulate envelope of spicula; surface of envelope even; spicula of envelope acerate, short, and stout, slightly curved. Ovary-surface tuberculate; tubercles long and narrow; spicula of the ovary umbonato-scutulate, minute.

Colour, dried state, pallid green.

*Hab.* River Amazon, on branches of trees pendent in the water (*Mr. R. Brown*).

Examined in the dried state.

I am indebted to Mr. Robert Brown for my knowledge of this interesting species, which he informed me he believed was collected from the River Amazon; and from the similarity of its structure to other species of *Spongilla* which I have received from Mr. Bates, who collected them from that river, I am induced to believe the locality is correct.

The specimen is considerably mutilated, so that the natural size and form cannot be determined with precision; in its condition when I first saw it in Mr. Brown's possession, it was about 3 inches in length by $1\frac{1}{2}$ inch in breadth and thickness. The stem of wood to which the Sponge is fixed, and which passes in a diagonal direction through the portion which was kindly given to me by Mr. Brown, does not much exceed a line in diameter; and the attachment is by an open network of flattened fibre, which embraces it closely in all parts.

The primary fibres of the Sponge are stout and nearly parallel to each other, and do not, as is usually the case, radiate from the stem of wood at right angles to its long axis. The secondary fibres uniting the primary ones are irregular in their direction. The surface is strongly spiniferous from the projection of the terminations of the primary fibres, and the spaces between the spinous terminations are open and entirely destitute of either membrane or reticular structure. The skeleton-spicula are $\frac{1}{60}$ inch in length, and their greatest diameter is $\frac{1}{666}$ inch.

The ovaries are situated immediately beneath and for a short distance within the outer surface of the Sponge, and none were observed more deeply seated. The attachment of the ovary-case or envelope is not by an especial pedicel or a single point; occasionally it has two or three points of adhesion to the same fibre by short pedicels, and it is often thus attached to two or more separate fibres, or it has one broad sessile attachment to a single fibre. The surface of the envelope is even, and there is no foramen on it, nor any indication of the position of that of the ovary within it. The ovary is closely embraced by the strong spicular envelope, and small elongate masses of its outer surface are projected, here and there, through the interstices of the envelope, causing the latter to be more or less tuberculous; and from the smallness of the interstices the tubercles are much greater in length than in thickness; while in the nearly allied species, *S. Batesii*, the tubercles of the ovarium-case are much thicker than they are high, and the spicula of the envelope are nearly twice as long as those of *S. Brownii*. The spicula of the envelope are more regularly acerate than those of the skeleton: they vary somewhat in size and degree of curvature; the dimensions of two that I measured were $\frac{1}{125}$ inch long by $\frac{1}{1224}$ inch diameter, and $\frac{1}{158}$ inch long by $\frac{1}{1364}$ inch diameter. They are disposed in a close but irregular network, seldom exceeding two spicula in thickness.

The scutulate spicula of the ovary are seated on the outer surface of the inner membrane of that organ, with the umbo of the scutulum outward; but in their natural condition they do not appear to

penetrate the outer membrane; and until the ovary has been rendered transparent by the aid of boiling for a few seconds in nitric acid, they are completely immersed in the tissues. They are disposed in a single layer, but are so closely packed together that their margins frequently overlap to a considerable extent. The form of the scutulum is truly that of a little shield, the lower surface being concave, while the upper one has a corresponding degree of convexity, and the umbo projects from its centre in the form of a small cone. The diameter of an average-sized one was $\frac{1}{1200}$ inch, and the height very nearly equalled the diameter.

Spongilla Batesii, Bowerbank.

Sponge massive, sessile; surface spiniferous; superficial interspaces open. Oscula, pores, and dermal membrane obsolete. Skeleton-spicula fusiformi-acerate, large, and stout. Ovaries spherical, spiculous, encased in an irregular but very open reticulate envelope; spicula of envelope acerate, stout, slightly curved. Ovary-surface tuberculate; tubercles short and very broad. Spicula of the ovaries, of exterior surface fusiformi-acerate, entirely spined, minute; spines of the middle portion large, cylindrical, terminations obtuse. Spicula of the interior surface umbonato-scutulate, minute.

Colour, dried state, pallid green.

*Hab.* River Tapajos, tributary to the Amazon, on the pendent branches of trees (*Mr. Bates*).

Examined in the dried state.

I received three fine specimens of this species from Mr. Bates. He describes them as being "found attached to stems and branches of trees which are submerged for three months in the wet season," and that "they are plentiful in the deep gloomy ygapos." The three specimens are very similar in form and dimensions, being of the size and shape of a common fowl's egg. Two of them only partially embrace the stems on which they are seated; the third entirely surrounds it. One of the specimens is evidently young; it is of a lighter green colour than the others, uniform in its structure, and has but few gemmules; and several of these are small and not fully developed. In the other two the greater part of the skeleton of each is brown, and has a dead appearance; and this portion is totally destitute of gemmules. United organically to the dead portions of the two Sponges, there are in each one or two patches of the skeleton which were evidently in a living state when collected. They are of a fresh dark green colour, and abound with mature ovaries; so that it would appear that the species is so far an annual that when the portion produced at one period has fulfilled the important offices of reproduction, and has shed its ovaries, its existence is then terminated.

The surface of the Sponge is strongly and rigidly spiniferous, and the superficial interspaces large and open, without the slightest vestige of either investing membrane or reticular structure to close the apertures.

The ovaries are not immediately at the surface, but a slight distance

below it. In the dried condition they are semiglobose, much smaller than the envelope in which they are contained, and are strongly tuberculated. When expanded by immersion for a short period in water, they assume a globose form and fill the envelope completely, the large coarse tubercles passing through the interstices of the network, and projecting considerably beyond it; and it is evident that the tuberculation is due to the powerful constriction of the surrounding network of the envelope, and there are no depressions on the inner surface of the ovary corresponding to the elevations on its exterior.

The manner in which the ovary is encased is very remarkable. There is a single large basal ring of spicula surrounding the foramen, at a distance from it of twelve or fifteen degrees, the whole circumference of the ring being composed of seven or eight spicula cemented together by their points, and rarely being more than two spicula thick. From this basal ring other spicula are projected, usually from the apical junctions, and a coarse net or basket-work is thus formed around the ovary—the size and form of the interstices being determined by the length and direction of the spicula. The ovaries are not sessile on the skeleton, but are elevated from the fibre on two or three short slender pedicels of spicula, and groups of six or eight of them are often clustered together in the large interspaces of the Sponge, mutually supporting each other by a number of these short pedicels, the greater part of the group having no connexion with the fibres of the skeleton.

The minute, entirely spined, fusiformi-acerate spicula of the exterior of the ovary are disposed without order in the substance of its walls, immediately beneath its surface, and appear to abound more especially in the large tubercles; and they are not visible under any circumstances until after preparation of the ovary by the aid of a slight boiling in nitric acid. At each end of the spiculum the spines are not very strongly produced, but towards the middle they are frequently as long as its greatest diameter; they are cylindrical in form, and terminated very obtusely. The spicula are very minute, and vary considerably in size; a large one measured $\frac{1}{384}$ inch in length, and one of the smallest was $\frac{1}{682}$ inch long.

The scutulate spicula are imbedded immediately within the inner surface of the ovary. They are closely packed together, and there appear to be two or three layers—the concave surface of the scutulum being towards the inner surface of the ovary. The diameter of an average-sized scutulum measured $\frac{1}{783}$ inch. The umbo is conical and acutely terminated.

### Spongilla corallioides, Bowerbank.

Sponge somewhat fan-shaped, sessile, branching and anastomosing; surface smooth and even. Oscula numerous, small, arranged in linear series on the outer sides of the branches, nearly equidistant, very slightly elevated. Pores inconspicuous. Dermal membrane thin and translucent, aspiculous. Spicula of the skeleton farcimulo-

cylindrical, very short and stout. Ovaria, form unknown, furnished with numerous scutulate spicula.

Colour, in the dried state, light ash-grey.

*Hab.* River Winguay, near Salto Grande, South America (*W. Bragge, Esq.*).

Examined in the dried state.

This interesting species was brought from the interior of South America by Mr. W. Bragge, who presented it to the Museum of the Royal College of Surgeons. In a letter to Prof. Quekett he states that it was "from the River Winguay, a branch of the Penk, from near Salto Grande, above Paysandu; it had a mass of red sandstone for its base when found." Salto Grande is on the River Japura, lat. 0° 28′ S., lon. 72° 37′ W. This river is discharged into the Amazon near Alvarens.

The Sponge is 9 inches high, 7 inches broad, and varies from 2 to 3 inches in thickness. It has a nearly square outline; and, in the dried state, both in rigidity and general appearance it very closely simulates a mass of finely branched coral. It is composed of a series of anastomosing branches, two or three lines in diameter, forming together a thick, somewhat fan-shaped mass. The surface of the branches is smooth and even, or slightly undulating; and they frequently assume an oval form from the influence of the opposite linear series of oscula, which are usually from two to three lines distant from each other.

The oscula rarely exceed half a line in diameter, and have usually a slightly thickened and elevated margin. I could not detect pores in the few pieces of dermal membrane that I found remaining on the Sponge; and both the dermal and interstitial membranes are thin and very delicate in texture. The skeleton-spicula are curved, and are remarkably short and stout: an average-sized adult one measured, length $\frac{1}{150}$ inch, greatest diameter $\frac{1}{857}$ inch; so that they are less than six times their own diameter in length. Among the large cylindrical spicula there were a few comparatively slender acerate ones; the dimensions of one of them was, length $\frac{1}{200}$ inch, diameter $\frac{1}{2000}$ inch. These spicula, although differing in form from the adult skeleton-ones, are only an early stage of their development, and they may be traced through all stages of their growth, from the acutely acerate to the hemispherically terminated adult spicula. The young as well as the old spicula are remarkably solid, and it is only by the aid of incineration that a very small central cavity can be detected in them. In one of the small pieces of the Sponge, mounted in Canada balsam, I found a fragment of an ovarium imbedded amidst the spicula of the skeleton. In this fragment the foramen was well preserved; and immediately around this orifice were numerous minute mammillæ at nearly equal distances from each other. A few of these elevations exhibited a tolerably distinct circular line around them, indicating, in a manner that admitted of little doubt, that they were scutulate spicula, very similar in size and structure to those of the ovaria of *S. Brownii* and *S. Batesii*, with the spicula of which species they appeared to coincide as nearly as possible in size. No other

form of spiculum was associated with them in this fragment of an ovarium; nor could I by the most careful examination of the fragments of the Sponge in my possession detect any other remains of the ovaria. Among the spicula separated by incineration, I found a single acuate spiculum of the following dimensions:—length $\frac{1}{231}$ inch, diameter $\frac{1}{2000}$ inch. These proportions are very nearly in accordance with those of the skeleton-spicula, and it is very probable that it has belonged to the case of one of the gemmules of this Sponge, especially as it is different from the spicula belonging to any of the known species of *Spongilla* from the River Amazon.

A portion of the sarcode still remains in the Sponge; and when expanded in water, it has a golden-yellow colour, and has a dense gelatinoid appearance.

SPONGILLA LACUSTRIS, Johnston.

*Ephydatia canalium*, Fleming.
*Halichondria lacustris*, Fleming.

Sponge sessile, branching; surface more or less hispid. Oscula simple, dispersed, small, and numerous. Pores inconspicuous. Dermal and interstitial membranes pellucid, spiculous; spicula numerous, fusiformi-acerate, entirely spined; spines abundant, conical, acute. Skeleton-spicula subfusiformi-acerate. Ovaria subglobose; spicula acerate, much and variably curved, disposed at right angles to lines radiating from the centre of the ovaries, entirely spined; spines conical, acute.

Colour dark green.

*Hab.* Lakes and rivers of England and Scotland.

Much uncertainty has existed regarding the specific distinctions belonging to the two well-known European species of *Spongilla*; and I can only attribute this indecision on the part of naturalists to their having hitherto appealed to the characters of external form and substance as a means of discrimination, to the almost total exclusion of those of internal structure, in which may be found striking and unfailing specific differences which never vary under any circumstances of locality or modification of external form.

Dr. Fleming has justly characterized this species as being "massive, rising into short rounded branches; the fibres are coarser and the substance denser than those of *S. fluviatilis*; the spicula, too, though similar in form, are thicker and about one-fourth shorter." This description, when both species are attainable, is good as regards the differential characters; but fortunately there are essential characters of much higher value, which exist in the spicula of the dermal membrane and in those of the ovaria, neither of which have, I believe, been noticed by previous writers on these subjects. Those of the dermal membrane are, under ordinary circumstances, very indistinct. If we examine the membrane in water between glasses, the spicula, as they lie immersed in the sarcode, are scarcely to be detected; but if previously mounted in Canada balsam, they become at once distinctly visible; they are very numerous, and are disposed over the

membrane without any approximation to order, and have an average length of $\frac{1}{222}$ inch, and are $\frac{1}{3333}$ inch in greatest diameter. They vary to some extent in their dimensions; but their form is always fusiformi-acerate, the spines are abundant, conical, and acutely terminated at all parts of the spiculum, but are not very strongly produced. The interstitial membranes are also plentifully supplied with the same description of tension-spicula as those of the dermal membrane. The dermal membrane of *S. fluviatilis* is aspiculous, and in this character therefore we possess an organic difference in the structure of the parts which leads us at once to a definite and correct mode of determining the species, however closely they may simulate each other in form.

The skeleton-spicula also differ in form from those of *S. fluviatilis*: in the latter they are purely acerate—that is, having the same diameter throughout the greater portion of the shaft of the spiculum, and attenuating only towards the terminations; while in the former the spicula are stouter and shorter in their proportions, and the attenuations commence at or very near the middle of the shaft of the spiculum, and are therefore fusiformi-acerate in shape.

But the greatest organic difference between this species and *S. fluviatilis* exists in the spicula of the ovaries. In the latter the case of that organ is strengthened and supported by a number of birotulate spicula, the rotulæ supporting the inner and outer surfaces of the case of the ovary, the shafts of the spicula being disposed at right angles to the surfaces; while in *S. lacustris* the walls of the ovary are totally destitute of birotulate spicula, but in their place we find a considerable number of curved, acerate, spinous spicula, not disposed at right angles to the surface of the gemmule, but imbedded in and lying parallel to the surface of that organ, thus affording a specific distinction so strikingly different from the corresponding structures in *S. fluviatilis* as to render the discrimination of the species easy and certain whenever the ovaries are present.

This species occurs plentifully at the bottom of the West Country Timber-dock, on the south side of the Thames, near Rotherhithe. It may frequently be found attached to the lower part of the large mooring-posts near the central parts of the docks, about 8 or 10 feet deep. I have never found it in this locality in shallow water or near the surface like *S. fluviatilis*, which is also abundant in the same dock attached to the floating timber. On the contrary, at Cookham, a few miles beyond Maidenhead, this species is abundant on the posts and sides of the wharfing-boards; and here it is always found near the surface of the water, and has a very fine emerald-green colour.

Spongilla alba, Carter.

Sponge sessile, encrusting, massive or subramose; surface rugged. Oscula simple, large, congregated in groups, confluent. Pores inconspicuous. Dermal membrane thin, pellucid, furnished with an irregular network of minute, slender, curved, entirely spined, acerate spicula; spines obtuse. Interstitial membranes abundantly furnished

with the same spicula as those of the dermal membrane. Skeleton-spicula fusiformi-acerate, large, and stout. Ovary-spicula disposed at right angles to lines radiating from its centre, cylindrical, stout, curved, entirely spined; spines acute, those at the ends of the spicula recurved.

Colour, alive, yellow, occasionally green (*Carter*).

*Hab.* Tanks, Bombay (*Carter*).

Examined in the dried state.

Mr. Carter, in his excellent paper on the "Freshwater Sponges in the Island of Bombay," describes this species as having a "flat or elevated surface, slightly convex, presenting gentle eminences or depressions or irregularly formed projections." The whole of these characters of form, there is no doubt, are correct as regards particular specimens. The mass for which I am indebted to Mr. Carter is a complete specimen about 3 inches in diameter, and exceeding 2 inches in height, having several short, stout, ramifying branches thrown out from its surface precisely as described by him, in the observations following his specific descriptions, as occurring when the species is found in circumscribed portions.

The oscula are large, and, in the specimen under consideration, they are not scattered, but are congregated in distinct groups in consequence of the convergence of the excurrent canals on particular parts of the surface of the Sponge; in the specimen under consideration there are four such groups, in which the oscula are all more or less confluent, forming in three out of the four cases a common orifice exceeding half an inch in diameter. This character is exceedingly striking, and does not appear to occur in any other species described as being found at Bombay.

The disposition of the spicula in the dermal membrane is very variable: sometimes they form a well-defined uniserial or biserial network; while at others they are dispersed in great profusion and without any approach to arrangement. They are long and slender in their proportions, and vary considerably in the amount of curvature they assume; and the obtuse spines with which the whole of the shaft is furnished are most abundant. They are small towards the apices of the spiculum, and increase in size as they approach the centre of the shaft, where they often attain an altitude equal to the largest diameter of the spiculum on which they are based, and they are nearly of the same diameter from base to apex. The same description of spicula are abundantly dispersed in the interstitial membranes, but do not appear to approach in any degree a reticulated arrangement.

The spicula of the ovaria are imbedded irregularly in the surface of its coriaceous coat; they slightly exceed in length those of the dermal and interstitial membranes, but they are two or three times their greatest diameter. They vary considerably in the degree of their curvature, and attenuate slightly from the centre of the shaft towards each end of the spiculum. The spines with which they are furnished are most abundant at their terminations, where they are thickly clustered, and are very much curved in the direction of the

central portion of the shaft, towards which part they are also fewer in number and less both in height and curvature: unlike those of the dermal membrane, the spines on these spicula are always acutely terminated.

To obtain a satisfactory definition of the spines of both these spicula, a power of about 600 linear should be used. The acerate spicula of the skeleton are about three times the length of those of the ovaria, and are also three or four times their diameter.

SPONGILLA CEREBELLATA, Bowerbank.

Sponge massive, sessile; surface furnished abundantly with short compressed branches, finely hispid. Oscula large, numerous, dispersed. Pores inconspicuous. Dermal membrane thin, translucent, spiculous; spicula slightly curved, cylindrical, entirely spined; spines of the middle of the shaft cylindrical; terminations obtuse, expanded or branched; spines towards the ends of the shaft conical, acute, recurved. Ovaria globose, smooth; spicula disposed more or less at right angles to lines radiating from the centre of the ovarium, of the same form as those of the dermal membrane.

Colour, dried state, light grey.

*Hab.* Freshwater tanks near Aurungabad, dominions of the Nizam, East Indies (*Dr. Bradley*).

Examined in the dried state.

I received this *Spongilla* from my friend Mr. Henry Deane, of Clapham, who informed me that it was sent to him from the East Indies by Dr. Bradley, who was in the service of the Nizam, and who had it sent to him from some water-tanks about 100 miles from Aurungabad, in the Nizam's dominions. Its dimensions are 6 inches in length, 4 inches in width, and $2\frac{1}{2}$ inches in height. The general surface is very irregular and cavernous, and has much resemblance to the surface of the brain of an animal; towards one end these irregularities are developed into short compressed branches, the surfaces of which are even and minutely hispid. The general texture of the Sponge is exceedingly friable, and the short branches afford nearly the only parts of the surface which has the dermal membrane remaining upon it. The dermal membrane is very thin and translucent, and is furnished with slightly curved, cylindrical, entirely spined spicula, the spines of which at the middle of the shaft are stout and cylindrical, with obtuse or expanded and sometimes slightly branched terminations, while those towards the ends of the shaft are acutely conical and are curved backwards towards the middle of the shaft. The ovaria are imbedded in every part of the Sponge in remarkable profusion; when expanded by immersion in water, they are perfectly globular, and have a smooth surface; when viewed by the aid of a Leiberkuhn and a power 100 linear, the spicula are so far imbedded as to be scarcely visible. They are of the same size and form as those of the dermal membrane. The imbedment of the spicula in the wall of the ovary is rarely parallel to the outer surface, nor are they confined to that part of the wall as in some closely allied species, but are dispersed throughout the whole of its substance, at various

angles to the surface of the ovary, without any arrangement; but in no case do they appear to be projected in lines radiating from the centre of that organ.

The only *Spongilla* with which this species might be confounded is *S. alba*, from the tanks of Bombay; but the oscula are not congregated in groups as in that species; and the spicula of the ovaries, although of the same form as those of *S. alba*, differ from them in being profusely furnished with numerous stout, cylindrical, more or less obtuse spines near the middle of the shaft; while the spines near the middle of the shaft of those of *S. alba* are fewer in number, not so strongly produced, and are conical and acutely terminated.

Spongilla Lordii, Bowerbank, MS.

Sponge sessile, coating; surface even, smooth. Oscula simple, dispersed. Pores inconspicuous. Dermal membraue pellucid, aspiculous. Skeleton-spicula acerate. Ovaria congregated on the basal membrane, very numerous; spicula entirely spined, fusiformi-cylindrical, dispersed on the surface. Basal membrane abundantly spiculous; spicula dispersed, same as those of the ovaries.

Colour ochreous yellow to green.

*Hab.* Lake Osogoos, and other lakes and rivers tributaries to the Columbia River; on the east slopes of the Cascade Mountains, about 6000 feet above the level of the sea (*Mr. J. H. Lord*).

Examined in the dried state.

The Sponge embraces the stems of a large species of reed for 8 or 10 inches of its length, and is about 6 or 9 lines in greatest thickness. In its general habit and the structure of its skeleton it closely resembles our British *S. fluviatilis*; but it differs from that species in the mode of disposition and structural peculiarities of the ovaries, which more closely resemble those of our British *S. lacustris*, from which, however, it differs in having the spicula of the ovaries nearly straight, while those of the last-named species are usually arcuate. The dermal membrane of *S. lacustris* also abounds in entirely spined tension-spicula, while that of *S. Lordii* is aspiculous.

There is a peculiarity in many of the spicula of the ovaria that I have never before seen in those of any other known *Spongilla*; and that is, the radiation of secondary canals from the central one of the spiculum to the outer surface. These secondary canals sometimes terminate in spinous projections; but this is not always the case.

I observed fragments of similar spicula in the infusorial earth from Duval's Creek, near Lake Munroe, St. John's River, Florida, sent to me by the late Prof. Bailey, of New York. It is therefore probable that *S. Lordii* will be found in the lakes and rivers of that district as well as at Vancouver's Island. This species is interesting from its close alliance in structure to the European type species of the genus, and from the very slight structural resemblance it has to the numerous species of the Amazon River, the principal characters by which it is connected with the latter series of species being the mode of the congregation and disposition on its basal membrane of its very numerous ovaries.

I have dedicated this species to Mr. Lord as a slight acknowledgment of the good services he has rendered to science by the collection of this and numerous other valuable specimens of natural history from unfrequented regions which he has explored.

Spongilla Dawsoni, Bowerbank.

Sponge sessile?, branching; surface smooth. Oscula and pores inconspicuous. Dermal and interstitial membranes abundantly spiculous; spicula fusiformi-acerate, entirely spined; spines numerous, short, and conical. Skeleton-spicula acerate or subfusiformi-acerate. Ovaria spherical; dermal spicula numerous, disposed in flat fasciculi, or groups of spicula parallel to each other; groups irregularly dispersed; spicula acerate or subcylindrical, entirely spined; spines numerous, obtuse, and ill-defined. Sarcode aspiculous.

Colour, in the dried state, emerald-green.

*Hab.* River St. Lawrence, Montreal, Canada (*Dr. Dawson, Mr. Fowler,* and *Rev. A. Kemp*); a lake near Brockville (*Rev. A. Kemp*).

Examined in the dried state.

About two years ago I received a small fragment of this species from Dr. Dawson, who stated that it was found in the River St. Lawrence, at Montreal; but, as the fragment was destitute of gemmules and very small, there were not sufficient characters to warrant a specific description of it. In October 1859 I received from the same gentleman a further supply of fragments of this species, containing ovaria, and giving a better idea of its form than those first sent to me. The largest of the pieces sent was $1\frac{1}{2}$ inch in length and $2\frac{1}{2}$ lines in diameter, evidently a portion of a longer branch. At the proximal end there is a short branch, 3 lines in length and 1 line in diameter; and the distal end divides into two small branches of similar dimensions to the first, thus satisfactorily indicating the branching habit of the species. In several parts of this piece there are ovaries imbedded in the Sponge, and there were many others in the fragments of the same species that accompanied it. The general external characters appear very like those of the European species *S. lacustris*; and, from this similarity, I have very little doubt of its surface in the living state having been smooth and even, as in that species. In the European species the branches spring from a broad spreading base, about half an inch in thickness; and I think it highly probable that the American species will be found to possess the same habit. I could not detect oscula on any of the fragments in my possession.

The dermal and interstitial membranes abound with tension-spicula, and especially the dermal one, in which they seem to attain their fullest degree of development. Their normal form is fusiformi-acerate; but, from the abundant production of the spines at their terminations, they frequently appear to be cylindrical rather than acerate. They are dispersed on these tissues rather unevenly, abounding in some spots, while they are comparatively scarce in others.

The spicula of the skeleton are of about the same proportions as

those of the European species. They are usually of the regular acerate form, but occasionally become subfusiform.

The spicula and their mode of arrangement in the dermis of the ovarium cannot be readily seen without the aid of treatment with hot nitric acid, in which they should be immersed for a few seconds, and the acid should then be immediately diluted with water, after which they should be dried on the glass on which they are to be mounted in Canada balsam. The spicula in the dermis of adult ovaries are very abundant. They are similar in form and proportions to those of the dermal membrane; but, generally speaking, they are more fully produced, and the greater portion of them are subcylindrical from the profusion of spines at their apices. Their form and mode of arrangement in the ovary render them exceedingly valuable as specific characters. In some of the young and incompletely developed ovaries I could not detect a single specimen of these spicula. The only difference I could find between these spicula and those of the dermal membrane was, that the spines on those of the latter were more sharply and fully produced, while on those of the ovary they were frequently ill-defined and often only in an incipient state, but very abundant.

In the preparation of the spicula for examination I found a few birotulate ones having the rotulæ very deeply divided. These spicula were no part of the Sponge in course of description, but were undoubtedly from the gemmules of another species inhabiting the St. Lawrence.

Spongilla cinerea, Carter.

Sponge sessile, massive; surface even. Oscula numerous, dispersed, large, more or less depressed. Pores conspicuous. Dermal and interstitial membranes spiculous; spicula fusiformi-acerate, small, entirely spined. Skeleton-spicula fusiformi-acerate, incipiently spinous. Ovaries globose; spicula acerate, slightly curved, entirely spined; spines conical, acute, at right angles to the shaft; spicula disposed at right angles to lines radiating from the centre of the gemmule.

Colour dark purple or rusty copper (*Carter*).

*Hab.* Freshwater tanks, Bombay.

Examined in the dried state.

Mr. Carter says of this Sponge, "While the investing membrane of this species remains intact, its surface presents a dark rusty copper-colour, purplish under water. It never appears to throw up any processes, and extends over surfaces of 2 and 3 feet in circumference, or accumulates on small objects to the thickness mentioned. It is distinguished from the other species by its colour, the fineness of its texture, and the smallness of its seed-like bodies and spicula."

I have received three specimens of this species from Mr. Carter; in all of them the oscula are large and considerably depressed, and the spaces between them generally abound with, comparatively, large and very conspicuous pores, which are not depressed like the oscula,

but present a sharp membranous margin level with the adjoining surface.

The spicula of the dermal membrane are not very numerous; they are slightly curved, and are entirely and abundantly spinous; and the spines are not in an incipient state, as on those of the skeleton, but are fully and distinctly produced; their spinous character is not usually distinctly apparent while *in situ*, in consequence of the density and colour of the sarcode and the abundance of the molecules imbedded in it; but when separated, there can be no mistake regarding them. These spicula are also found imbedded in the interstitial membranes, but they are comparatively rare in those tissues.

The incipient spines of the spicula of the skeleton are few and minute, and require a power of about 400 linear to render them distinct to the eye, and, unless it be on large and fully developed spicula, they are frequently indicated only by a slight elevation of the profile lines of the spicula.

Although in some points of organization this species is the representative in India of our European *S. lacustris*, there is no similarity whatever in external form: while *S. lacustris* is always arborescent, the Indian one is always sessile and coating, rarely attaining an altitude exceeding an inch. In *S. lacustris* the skeleton-spicula are acerate, of nearly the same diameter for the greater portion of their length; while in *S. cinerea* they are distinctly fusiformi-acerate, gradually attenuating from the middle of the shaft towards each end; they are also larger and have a greater length than those of *S. lacustris*, measuring $\frac{1}{75}$ inch long, while the latter is but $\frac{1}{90}$ inch long, and are entirely destitute of incipient spines.

In the size of the ovaries of the two species the proportional diameters are the reverse of the measurements of the skeleton-spicula. The largest ovary is that of *S. lacustris*, $\frac{1}{40}$ inch in diameter, while that of *S. cinerea* is but $\frac{1}{66}$ inch in diameter.

The mode of disposition and the form of the dermal spicula of the gemmules of the two species is very similar: they are each abundantly spinous and variable in size; but those of *S. cinerea* are all only slightly curved, while those of *S. lacustris* are frequently curved to so great an extent as to form a semicircle. In length they are as nearly as possible equal; but in *S. lacustris* they have a diameter twice as great as those of *S. cinerea*, the average diameter of the latter being $\frac{1}{7500}$ inch, while that of the former is $\frac{1}{3649}$ inch.

Spongilla Carteri, Bowerbank.

*S. friabilis*, Carter.

Sponge sessile, massive; surface even. Oscula numerous, dispersed. Pores conspicuous. Dermal and interstitial membranes thin, pellucid, aspiculous. Skeleton-spicula fusiformi-acerate, stout. Ovaries subglobose; spicula fusiformi-acerate, disposed at right angles to lines radiating from the centre of the ovary, short, and stout.

Colour bright green.

*Hab.* Freshwater tanks, Bombay (*Carter*).

Examined in the dried state.

This species is not *S. friabilis*, Lamarck, the ovaries of which are furnished with birotulate spicula, while those of the like organs in the Sponge under consideration are fusiformi-acerate. I have therefore named it after the author who first described it, in commemoration of the valuable services he has rendered to science in this and other departments of natural history.

In the absence of specimens of the European species *S. friabilis*, Lamarck, or *S. fluviatilis* of Johnston, and with the vague and meagre description only of that Sponge before his eyes, it is by no means a matter of surprise that Mr. Carter should have believed the Bombay Sponge to be the same species as the European one. The skeleton-spicula of the two species do not differ very materially from each other: those of *S. friabilis*, Lam., are longer and more purely acerate in form, having a length of $\frac{1}{72}$ inch, and being $\frac{1}{1604}$ inch at their greatest diameter; while those of *S. Carteri* are $\frac{1}{75}$ inch long, the greatest diameter being $\frac{1}{1345}$ inch, and in consequence of their greater proportionate diameter they are distinctly fusiformi-acerate.

The spicula of the ovaries are, in comparison with those of the ovaries of other species of *Spongilla*, very large and stout; an average-sized one measured gave the following dimensions:—length $\frac{1}{143}$ inch, greatest diameter $\frac{1}{2727}$ inch.

The above-named author, in his paper, states that this Sponge "seldom throws up projections much beyond its surface, does not appear to be inclined to spread much, and is matted and confused in its structure towards its base and round its seed-like bodies."

SPONGILLA PAUPERCULA, Bowerbank.

Sponge coating and branching; surface smooth. Oscula and pores inconspicuous. Dermal membrane aspiculous. Skeleton-spicula fusiformi-acerate, stout, and rather short. Interstitial membranes aspiculous. Sarcode aspiculous. Ovaries globular, smooth; spicula acerate, small, few in number.

Colour, in the dried state, light brown.

*Hab.* In the water-pipes of Boston, United States (*Prof. J. W. Bailey*, New York; *Dr. Asa Gray*, Cambridge, near Boston, U.S.).

Examined in the dried state.

I am indebted to Dr. Asa Gray for specimens of this species. They consist of a number of fragments of branches, the longest of which rather exceeds an inch in length, and are of about the diameter of a goose-quill. The general character of the Sponge appears to be very similar to that of our European species *S. lacustris*; but it is not so strongly constructed: and this may perhaps arise from the peculiarity of its place of growth; in a more genial locality it would probably be much more robust in its general habit, and the ovaria, it is probable, would be more fully and completely developed and more abundantly supplied with their proper spicula, which are of the same form as those of the skeleton, but not more than about half their size: these appear to be very few in number, and to be irregularly dispersed on their surface.

In a letter from the late Prof. J. W. Bailey, dated November 30,

1856, he writes, "I forgot to mention that *Spongilla* grows abundantly in the water-pipes by which the city of Boston is supplied with water from a small lake. I think it must materially diminish the water-way in the pipes, and probably be connected with the bad taste which the water has in seasons of great drought." With the latter part of these observations especially I am strongly inclined to concur, as I have always observed that a small portion of either of our European species rapidly deteriorated a comparatively large body of water to such an extent as to render it unfit to sustain either its own life or that of any other animals of higher organization. The encouragement of *Confervæ* in tanks supplied with such water would probably help to correct the deleterious effects of the *Spongilla*.

## EXPLANATION OF PLATE XXXVIII.

Fig. 1. *Spongilla fluviatilis.*—*a.* A spiculum of the skeleton, × 108 linear. *b.* A birotulate spiculum of the ovaria, ×660 linear. *c.* A view of the external surface of a rotula, ×660 linear.

2. *S. Leidii.*—*a.* A spiculum of the skeleton, ×108. *b.* A birotulate spiculum of the ovaria, ×660.

3. *S. Capewelli.*—*a.* A spiculum of the skeleton, ×108. *b.* A birotulate spiculum of the ovaria, ×660. *c.* A view of the external surface of a rotula, ×660.

4. *S. Meyeni.*—*a.* A spiculum of the skeleton, ×108. *b.* A birotulate spiculum of the ovaria, ×660.

5. *S. plumosa.*—*a.* A spiculum of the skeleton, ×108. *b.* A birotulate spiculum of the ovaria, ×660. *c.* A view of the internal surface of a rotula, ×660. *d.* An elongate pileated spiculum, an early condition of the subsphero-stellate form, ×400. *e.* A fully developed multiradiate, subsphero-stellate, pileated spiculum of the sarcode, ×400.

6. *S. Baileyi.*—*a.* A spiculum of the skeleton, ×108. *b.* A birotulate spiculum of the ovaria, ×660. *c.* One of the tension-spicula of the membranes, ×660.

7. *S. gregaria.*—*a.* A spiculum of the skeleton, ×108. *b.* One of the spicula of the case of an ovarium, without spines, ×108. *c.* A spiculum of the case of an ovarium, abundantly spinous, ×108. *d.* A side view of one of the birotulate spicula of an ovary, ×1100. *e.* A view of the external surface of a rotula, ×1100.

8. *S. paulula.*—*a.* A spiculum of the skeleton, ×108. *b.* One of the inequibirotulate spicula of the ovaria, ×660.

9. *S. reticulata.*—*a.* A spiculum of the skeleton, ×108. *b.* A boletiform spiculum of the ovaria, ×660.

10. *S. recurvata.*—*a.* A spiculum of the skeleton, ×108. *b.* A slender boletiform spiculum of the ovaria, ×660. *c.* A multihamate, birotulate spiculum from the ovaria of the same Sponge, ×660.

11. *S. Brownii.*—*a.* A spiculum of the skeleton, ×108. *b.* One of the spicula of the reticular case of an ovarium, ×108. *c.* An umbonato-scutulate spiculum of the ovaria, showing the external surface, ×660. *d.* A side view of one of the same form of spiculum represented by fig. *c*, ×660.

12. *S. Batesii.*—*a.* A spiculum of the skeleton, ×108. *b.* An entirely spined fusiformi-acerate spiculum from the outer surface of an ovarium, ×660. *c.* One of the umbonato-scutulate spicula from the inner portion of the wall of an ovarium, ×660.

13. *S. corallioides.*—A spiculum of the skeleton, ×108.

14. *S. lacustris.*—*a.* A spiculum of the skeleton, ×108. *b.* A fusiformi-

acerate, entirely spined tension-spiculum from the dermal membrane, ×660. *c*. A subarcuate, acerate, entirely spined spiculum from the outer surface of an ovarium, ×660.

15. *S. alba.*—*a*. A spiculum of the skeleton, ×108. *b*. A fusiformi-acerate, truncately spined tension-spiculum from the dermal membrane, ×660. *c*. An entirely and recurvately spinous cylindrical spiculum from the surface of an ovarium, ×400.
16. *S. cerebellata.*—*a*. A spiculum of the skeleton, ×108. *b*. An entirely spined cylindrical spiculum from the surface of one of the ovaria, ×400.
17. *S. Lordii.*—*a*. A spiculum of the skeleton, ×108. *b*. An entirely spined fusiformi-cylindrical spiculum from the surface of one of the ovaria, ×660.
18. *S. Dawsoni.*—*a*. A spiculum of the skeleton, ×108. *b*. A subcylindrical, entirely spined spiculum from the surface of an ovary, ×400.
19. *S. cinerea.*—*a*. A spiculum of the skeleton, ×108. *b*. An entirely spined acerate spiculum from the surface of an ovary, ×660.
20. *S. Carteri.*—*a*. A spiculum of the skeleton, ×108. *b*. A small fusiformi-acerate spiculum from the surface of an ovary, ×108.
21. *S. paupercula.*—*a*. A spiculum of the skeleton, ×108. *b*. An acerate spiculum from the surface of an ovary, ×108.

## 2. On some Insects collected in Madagascar by Mr. Caldwell. By H. W. Bates, Esq.

A small collection of insects made in Madagascar by Mr. Caldwell (the second remitted by that gentleman) having been placed in my hands for examination by Dr. Sclater, I now communicate the results to the Society. Unfortunately the specimens arrived in a very dilapidated condition, owing to their not having been securely pinned in the box; so that many are not now in a state to be identified, thus reducing the number of species in our already scanty list. Twenty-seven only are here passed in review, which, added to the twenty-one named from the former collection by Messrs. Hewitson and Walker, make the small total of forty-eight. A rather large number of insects, however, chiefly of the orders Coleoptera and Lepidoptera, have now been described from Madagascar, sufficient, perhaps, to give us a pretty fair idea of the entomological fauna of the island. It has occurred to me, therefore, that it would be worth while to analyze the whole list, so as to ascertain how far this department confirms what has been advanced by the cultivators of other branches of zoology, especially ornithologists, as to the very high degree of peculiarity of the fauna.

The literature of the entomology of Madagascar dates from towards the end of the last century, when Olivier in his 'Entomologie' figured and described a small number of Coleoptera from the island, which had been deposited by Commerson in the Museum of the Jardin des Plantes. In 1830 an ardent entomological collector, Justin Goudot, visited the island and reaped a rich harvest; in fact, nearly all that is known in Europe even now of the insects of Madagascar is the result of the researches of this practised hand. Goudot's expedition gave rise only to two special works, and these unfortunately were very limited: one was Klug's 'Insekten von Ma-

dagascar,' a treatise read before the Königliche Akademie der Wissenschaften of Berlin in 1832; and the other, Boisduval's 'Faune Entomologique de Madagascar,' &c., published in 1833. The former described little more than 200 Coleoptera; and the latter is confined to a portion of the Lepidoptera. The bulk of Goudot's collections, including all the striking and peculiar forms, seems to have been distributed chiefly amongst amateurs, who described the species irregularly in different French periodicals; many, however, have been systematically described in general monographs of families by various French authors. Since Goudot's time a few small collections made by Coquerel and others have arrived in France. The reopening of the island to Europeans has not yet produced results satisfactory to entomologists, as scarcely any of the rarer and more striking species collected by Goudot have been rediscovered.

The peculiarities of the Mammal fauna of Madagascar are so well known to zoologists that it is almost superfluous to mention them here. Such are the absence of Pithecoide Monkeys, Pachyderms (with the exception of one species at least of Wild Hog), Solidungula, Ruminants, and *Felidæ*, groups so richly represented in the adjoining continent,—and on the other hand, the presence of numerous genera and species of Lemurs unknown in every other part of the world, with two or more peculiar genera of *Viverridæ*, constituting, as far as is known, the small stock of Carnivora which the island possesses. The fauna, however, has been systematically treated only as far as birds are concerned, Dr. Hartlaub having contributed a special work on the subject. According to this learned ornithologist, the bird-population of Madagascar is in the highest degree peculiar. Dr. Hartlaub even goes so far as to deny any close relationship between it and continental Africa, hinting that its connexion lies rather with South-eastern Asia. The statistics given are certainly very striking: thus out of the total number of 202 birds no less than 96 species and 29 genera are peculiar to the island, 42 species only being common to it and continental Africa. The number of characteristic African groups wanting in Madagascar supplies almost a parallel to the case of the Mammalia. The facts which have suggested to him an Indian alliance are the existence in Madagascar and Mauritius of four Indian genera and three or four species, besides six other genera which, although peculiar to Madagascar, bear the stamp of Indian and Australian rather than of African origin.

An analysis of the Insect fauna, at least of eleven of the better-worked families or tribes in the orders Lepidoptera and Coleoptera, has yielded me the following results:—Out of 282 species (being all that have been described from the island, of the 11 groups), 221 species and 26 genera are peculiar to Madagascar; whilst 48 species only are common to the island and the continent. Thus there is a much larger proportion of species of insects than of birds peculiar to the island, and a somewhat smaller proportion common to it and Africa —a result which may perhaps be due to the more limited powers of locomotion of insects than of birds. The generic peculiarity of the island is perhaps not quite so strikingly exhibited in insects as in

birds—26 out of 90 genera of insects being peculiar, whilst in birds there are 29 genera out of 141—ornithological genera seeming to form groups of a lower rank than those usual in entomology. An examination of the Madagascar genera which are not African brings to light the Indian element, but not in so prominent a way as that claimed by Dr. Hartlaub as a result of his analysis of the bird fauna. For out of the 64 genera not peculiar to the island, no less than 61 are also represented in Africa—two only of the remaining three being Indian or South-east Asian forms, and the third Indian and American, but not African. Lastly, of the 26 exclusively Madagascar genera, all have their nearest relatives in African forms except two, and these are very remarkable; for one, the Cetoniade genus *Chromoptila*, claims for its next relative *Bombodes*, a Himalayan genus; and the second, the Cicindelide *Pogonostoma*, is closely allied to a purely Tropical American form, *Ctenostoma*,—the two genera indeed forming an isolated subfamily thoroughly distinct from any other group.

I think it will be admitted, notwithstanding these discrepancies, that there is a great general similarity in the results arrived at by Dr. Hartlaub's analysis of the birds and the present examination of a portion of the insects. The differences with regard to the relationship of the fauna, I think, tend to show that Dr. Hartlaub has rather overestimated the importance of the Indian element, and that Dr. Sclater's view, namely, that in Madagascar the African organic type is pushed to its extreme development, lies much nearer the truth. Why should Indian rather than African relationship be claimed for the Madagascar fauna, when, according to his own showing, only three or four Indian species with four genera are contained in it, whilst it has 42 African species and 23 African genera?

If the existence of a small number of Indian or Archipelagic genera in Madagascar and Mauritius, unknown in continental Africa, be a fact which must influence our views of the Madagascar fauna, so must also the occurrence of a genus having a near relationship only to a Tropical American form, especially as this latter is not a solitary fact—another Madagascar insect (belonging to a family which I have not included in this examination), namely *Urania ripheus*, belonging (or having been considered until very lately to belong) to a purely Tropical American genus. The presence of these anti-African elements, the absence of so many families and orders of Mammalia common on the neighbouring continent, and, lastly, the existence of numerous genera and species quite peculiar to the island constitute, doubtless, the main features of the fauna of Madagascar. The peculiarity of the endemic genera and species, however, must not be overrated through dwelling too much on the great singularity of a few of them. There are extremely few entire families or subfamilies wholly peculiar to this island; indeed in the portion of the insect fauna which I have examined there are none, and in the birds there are only two small families of this kind, each of which is represented by a single genus. Were Madagascar a distinct zoological province, as some naturalists have seemed inclined to maintain, there ought to

be, as in the South American, Australian, and Indian provinces, many such groups with clusters of peculiar genera and species. It might be said that, with the exception of the absence of so many groups of continental Mammals, Birds, and other classes, the peculiarities of Madagascar are not very much greater than those of some areas of similar dimensions forming parts of a continuous continent. There are areas of this size in Tropical America which contain numbers of genera and species in various classes, some of them highly peculiar, found nowhere else on the same continent. Regarding the existence of anti-African types, it must not be forgotten that many countries contain one or more isolated forms which are more nearly related to others of distant regions than to those of their own. Africa itself contains, in the midst of a fauna completely distinct, a few scattered Tropical American genera—that is, genera found in these two lands, and nowhere else on the globe. *Lepidosiren* is one of these, and *Hiletus*, an equally anomalous genus of Coleopterous insects, another.

The view taken by Dr. Hartlaub, were it pushed to an explanation, would naturally lead to the hypothesis that Madagascar with its islands was once more isolated from Africa than from lands since submerged in the Indian Ocean, containing a fauna of an Indian character; for on such a supposition only could the predominance of Indian over African features be explained, if it were true. But if the independence and peculiarity of its fauna be more insisted on, we should have to suppose that the island is the site of an ancient tract of land in the Indian Ocean, which had throughout long ages maintained an independent fauna. It seems to me, however, that the peculiar organic features of Madagascar would be better explained by supposing that the island (whether previouly stocked with anti-African forms, or not) was at one time much more closely connected with Africa than it now is, and that the time of connexion was anterior to the date when the continent became peopled by *Simiidæ* and the bulk of its present Mammalia, but posterior to the introduction of Lemurs. Subsequently to this epoch we may suppose it to have become isolated as we now find it; the lapse of time since the severance having been sufficient to cause the present divergence of the faunas—a divergence caused, however, as much by the extinction of old forms on the continent, once common to both lands, through the immigration or introduction of so many new ones, as by the origination of new species and genera in Madagascar allied to prototypes once common to island and continent. The changes in the Madagascar fauna have not been carried on in all the groups, a family here and there only having shown this multiplication of genera and species. As proof of this, I may mention that out of the 26 genera of insects peculiar to Madagascar, no less than 17 belong to one (the *Cetoniadæ*) out of our 11 groups; the Lemurs may possibly be a similar case.

It must be confessed, however, that our knowledge of the faunas of these lands is not yet sufficient to enable us to come to sound conclusions on these interesting subjects. These remarks must be

taken merely as a sketch of an hypothesis under which labourers in the field of Madagascarene and African zoology may, if they choose, collect and apply their facts.

## Order LEPIDOPTERA.

1. PAPILIO PHORBANTA, Linn.

This species, of which there is one example only in the collection, is stated by Dr. Boisduval, our chief authority on the Lepidoptera of this part of the world, to be peculiar to Mauritius, and to be the only one of its group found in this island. If it be really a native of Madagascar, it will make the third species of this most beautiful and distinct section of the genus *Papilio* occurring there. The distribution of the group, which may be called the "*nireus*-group," after the best-known species belonging to it, shows how close is the relationship of the Madagascar fauna to those of the neighbouring islands and continental Africa—no near relative of any of the forms being found in other parts of the world. We are now acquainted with seven species comprised in it; these are—

(1) *P. charopus* (Westwood). Known only from the Gold Coast, Western Africa.

(2) *P. oribazus* (Boisd.). A near relative of *P. charopus*, peculiar to Madagascar.

(3) *P. nireus* (Linn.). Found commonly from Tropical Western Africa to Plettenberg Bay, near the Cape of Good Hope.

(4) *P. bromius* (Doubleday). Closely allied to *P. nireus*, and found only in Ashantee.

(5) *P. phorbanta* (Linn.). Known hitherto only from Mauritius.

(6) *P. epiphorbas* (Boisd.). Intermediate in many points between *P. phorbanta* and *P. disparilis*, and peculiar to Madagascar.

(7) *P. disparilis* (Boisd.). Distinguished by the great disparity in colour of the sexes, and known only from the Island of Bourbon.

It must be remarked that these species do not constitute a series of compact and independent forms; for they are very unequally related in their specific characters, and the chief member of the group, *P. nireus*, is subject to great local modification, so much so that four species have been made of it by different authors*.

2. TERIAS DESJARDINSII (♂), Boisd. Faun. Entom. de Madagascar, p. 22, pl. 2. f. 6.

Boisduval states that the female of this species is unknown. An example of this sex occurs in the present collection. It differs from the male in being a little larger and of a paler hue, with a broad dark-brown apical border to the fore wing, and the hind wing without border. Beneath, the only difference from the male is the presence of a reddish spot near the apex of the fore wing.

* The different forms of *P. nireus* constitute two species in G. R. Gray's 'List of Papilionidæ of the British Museum' (1856). The whole are reunited under one by the latest authority, Trimen, in his 'Rhopalocera Africæ Australis,' Cape Town, 1862.

3. Danais chrysippus, Linn.

A common and widely distributed insect, being found as far north as South-eastern Europe, and also over a great part of Tropical Asia.

4. Danais phædone, Fabricius.

This has hitherto been recorded only as inhabiting the Island of Mauritius. There is one example in the collection.

5. Euplœa euphone, Boisd. Faune Ent. de Madag. p. 36, pl. 3. f. 1.

Inhabits also Mauritius.

6. Acræa lycia, Godart.

An apparently common African insect, ranging from Sierra Leone to Natal.

7. Atella phalanta, Drury.

This species, which appears to be common in Madagascar, is one of the most widely distributed of insects, being found in all the warmer parts of Africa, as well as in Southern and Eastern Asia and the western islands of the Indian archipelago.

8. Hypanis anvatara, Boisd. Faune Ent. de Madag. p. 56, pl. 7. f. 5.

This can scarcely be considered anything more than a local variety of *H. polynice* of Tropical Africa, its difference from that species being very slight. As a local variety or race, however, it is peculiar to Madagascar.

9. Junonia rhadama, Boisd. Faune Ent. de Madag. p. 44, pl. 7. f. 2.

One of the most beautiful of the Madagascar Diurnal Lepidoptera, and formerly thought to be peculiar to the island; but it has since been found by Dr. Peters in Mozambique. The genus occurs in all quarters of the world except Europe, and is richly represented in Eastern and Southern Africa.

10. Diadema bolina, Linn.

There is one example of this common and widely distributed tropical insect in the collection. The species is said to occur at Cayenne, although the genus is otherwise unknown in the New World. If it really has been found there, it must have been accidentally introduced; for during my travels in the adjoining region of the Amazons I saw no trace of it; and it has never been found in the numerous collections received from other countries of Tropical America.

11. Neptis kikideli, Boisd. Faune Ent. de Madag. p. 50.

A species peculiar, as far as at present recorded, to Madagascar. The genus occurs, in numerous species, in all the warmer parts of the old continent.

12. CHARAXES CACUTHIS, Hewitson, Exot. Butt., Char. f. 12, 13.

This fine species has only recently been discovered in Madagascar, by Mr. F. Plant. There is a mutilated example in the collection. Its nearest relative, according to Mr. Hewitson, is *C. etheta* of Western Tropical Africa.

13. MYCALESIS NARCISSUS, Fabr.

A well-known South-African Butterfly. Found also in the island of Mauritius.

14. EREBIA TAMATAVÆ, Boisd. Faune Ent. de Madag. p. 60. pl. 8. f. 6, 7.

This, with *Erebia cassius*, and several other allied species inhabiting Southern Africa and the neighbouring islands differ considerably from the typical *Erebiæ* which are so abundant in the alpine districts of Europe and in high northern latitudes up to the Arctic circle. They will eventually, no doubt, be formed into a genus apart*. *Erebia tamatavæ* seems to be peculiar to Madagascar.

15. LYCÆNA BATIKELI, Boisd. Faune Ent. de Madag. p. 24, pl. 3. f. 5.

There is one mutilated example of this species in the collection.

16. ISMENE FORESTAN, Cramer.

Found also in Eastern Africa. The genus is widely distributed in the tropical parts of the Old World.

## Order HOMOPTERA.

17. PLATYPLEURA, sp.

There are two examples of a *Cicada* of this genus, which have much resemblance to the common *Platypleura capensis* (Linn.) of the Cape of Good Hope.

## Order COLEOPTERA.

18. GLYCIPHANA LUCTUOSA, Gory & Percheron, Mon. des Cét. t. 55. f. 5.

A Cetoniade, found also in Mauritius. The genus is common to all the warmer parts of the Old World.

19. ORYCTES PYRRHUS, Burmeister, Handbuch der Entom. v. p. 197.

There is a pair, male and female, of this insect in the collection. The species belongs to a section of the genus which has representatives in Mauritius, Java, Australia, and Europe.

* This has recently been done by Wallengren (Fregatten Eugenies Resa), who has proposed the name of *Pseudonympha* for the group.

20. Polybothris colliciata, Guérin-Méneville, Magasin de Zoologie, pl. 27.

A second species of this group, *P. auropicta*, was contained in the former collection sent by Mr. Caldwell. The group, formerly considered a genus, comprises fourteen species, all peculiar to Madagascar; it has been reunited by Lacordaire, the latest authority on the subject, to *Psiloptera*, a widely distributed genus, in consequence of the want of absolute structural characters to distinguish it; the species, however, may be considered as forming a good subgenus.

21. Lacon vestitus, Klug, Ins. von Madag. p. 64.

Peculiar to Madagascar. The genus, however, is a cosmopolitan one.

22. Macrotoma corticina, Schönh. Syn. Ins. iii. p. 345, n. 54.

This species is also peculiar to Madagascar; but many closely allied species are known to inhabit the warmer parts of the Old World.

23. Stellognatha maculata, Oliv. Entom. t. iv. p. 68, n. 87, pl. 7. f. 49 *a*, *b*, and f. 174 *a*, *b*.

Both species and genus of this large and striking Longicorn are peculiar to Madagascar. It belongs to the *Sternotominæ* group, which is peculiarly African.

## Order ORTHOPTERA.

24. Mantis marginata, Fab. Ent. Syst. Suppl. p. 191. (*M. pustulata*, Stoll, f. 73; Serv. Hist. Nat. des Orthop. p. 186).

This is a common African insect, and is found also in Mauritius.

25. Mantis caldwellii, n. sp.

♀. *Modice elongata, pallide viridis. Caput robustum, denticulo parvo utrinque inter basin antennæ et oculum. Prothorax latiusculus* (long. 7½ lin.), *supra coxas anticas paulo ampliatus, lateribus leviter denticulatis. Abdomen grossum, prothoraci longitudine æquale, supra rubro maculatum. Elytra abdomine paulo longiora, apice modice attenuata, costa arcuata, area costali tertiam partem latitudinis constituente; viridi-opaca, stigmate concolore; utrinque marginem posticam versus hyalina. Alæ hyalinæ, venis roseo tinctis, apicibus viridibus. Pedes simplices, modice elongati: coxis anticis supra multi-denticulatis, intus cum femoribus immaculatis.*

Long. 1″ 7‴—1″ 9‴.

This species, of which there are two female examples, has no very close relative at present known—the nearest approximation being the group of species allied to *M. unimaculata* of Stoll, natives of Eastern Africa.

26. Popa undata, Fabricius, Entom. Syst. ii. p. 19.

*Theoclytes undata*, Serville, Hist. Nat. des Orthop. p. 152.

*Mantis undata*, Charpentier, Orthop. Descr. et Dep. ♂ ♀, pl. 38.

*Popa spurca*, Stål, Öfversigt af Kongl. Vetenskaps Akademiens Förhandlingar, 1856, p. 169.

This remarkable *Mantis*, which, when its wings are closed, has a striking resemblance to a withered fragment of a tree-branch, is hitherto known only as an inhabitant of Southern Africa. The Madagascar specimen (a female) is about one-third larger than Natal examples; but the only difference, besides size, which I find is the greater breadth of the hyaline streaks accompanying the transverse veins of the wings.

27. Acridium ruficorne, Olivier, Encycl. Méthod. ix. p. 221. n. 25.

Found also at the Cape of Good Hope.

## 3. A List of the Birds inhabiting the Islands of Timor, Flores, and Lombock, with Descriptions of the New Species. By Alfred R. Wallace.

(Plate XXXIX.)

The chain of islands situated to the east of Java, and ending in Timor, forms a natural subdivision of the Malayan archipelago, being distinguished by peculiarities of physical geography as well as by a characteristic fauna. These islands all contain active volcanoes, and are for the most part of volcanic origin. Timor, however, which lies somewhat obliquely to the rest, consists in a great measure of ancient sedimentary rocks, which seem to have been exposed for long periods to volcanic convulsions, since they are everywhere shattered and distorted in a remarkable manner. All of these islands have a climate which differs from that of the rest of the archipelago in being remarkably dry; and this has produced a characteristic vegetation, in which spiny and prickly shrubs abound, while the dense luxuriant forests of the regions nearer the equator are quite unknown. The forest-trees of Timor are chiefly *Eucalypti* and Acacias, thinly scattered over bare and gravelly slopes; while it is only in the damper and more sheltered spots that patches of bush and thickets occur.

I visited Timor twice, and collected for nearly five months in both the eastern and western districts, obtaining 112 species of birds. Ill health and wars between the Portuguese and the natives prevented me from going far into the interior, where, especially on the south coast, I have reason to believe many additional species might have been obtained. Six other birds are said to be from Timor, mostly collected by the naturalists of the Dutch Government expeditions, making a total of 118 species from this island. My assistant, Mr. Allen, collected for nearly four months in the large island of Flores, and obtained eighty-six species of birds; and I am not aware that a

Wolf del. et lith.

M&N Hanhart imp.

PTILONOPUS ALBOCINCTUS.

single species was previously known from this locality. From the next island, Sumbawa, I have obtained no collections. A few are indicated by Bonaparte as existing in the Leyden Museum, the whole of which, with one exception only (*Trichoglossus forsteni*), are found in the adjacent islands. In the next island, Lombock, I collected myself for two and a half months, obtaining sixty-three species of birds. The island of Bali commences the Indian region of zoology, which we have not now to consider; but I may mention that, according to the Dutch naturalist Zollinger, its fauna is absolutely identical with that of Java. The total number of species known to inhabit this group of islands is 186. Taking into consideration the comparative sizes of the islands, the above numbers may be supposed to represent with tolerable fairness their respective bird populations, and will therefore furnish us with materials for some interesting comparisons.

The Timorese subfauna, as we may conveniently name it, differs strikingly from the Moluccan in the absence of such genera as *Lorius*, *Eos*, *Eclectus*, and *Lycocorax*, and also of *Tanysiptera*, *Alcyone*, *Criniger*, and the subgenera *Iotreron* and *Cyanotreron*, all of which, though not peculiar to the Moluccas, are very characteristic of that group of islands. On the other hand, it shows a closer connexion with Australia than any other part of the archipelago, as evidenced by five genera, *Sphecothera*, *Gerygone*, *Pardalotus*, *Glycyphila*, and *Amadina*, which are found in this chain of islands, but do not pass into the Moluccas or Celebes. The number of species which appear to be restricted to the Timorese subfauna is eighty-one, many of which, however, are very slight modifications of Australian species. On the other hand, there is not a single genus confined to the group, or which can be said to have its metropolis in it—indicating that the fauna is strictly derivative, and of not very ancient date. In endeavouring to determine the origin of this fauna, we must eliminate those species and genera which, having a wide distribution and roaming habits, can give us little definite information. These are chiefly raptorial and aquatic birds, with a portion of the Passeres; and I find that fifty-seven species of this nature are identical with those of surrounding countries, while thirty-five more are representative species which cannot be referred to any one island rather than another for their probable origin. Deducting these ninety-two species, we have left a rather larger number of birds which we can trace directly either to Australia on the one side or to Java on the other.

The species which appear to be confined to each island may be classed as follows—

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Lombock | 4, | of which | 1 | genus is | Australian, | 1 | genus | Indian, |
| Flores | 12, | ,, | 5 | genera are | ,, | 2 | genera | ,, |
| Timor | 42, | ,, | 16 | ,, ,, | ,, | 4 | ,, | ,, |

showing that while there is a great preponderance of the forms of the Australian region in Timor, they decrease going westward, till in Lombock they are equalled by the Indian forms. The species which

are *identical* with those of Java or Australia show the proportionate influence of the two countries in a yet more striking manner.

| | Lombock. | Flores. | Timor. |
|---|---|---|---|
| JAVAN. | | | |
| Species ..... | 32 | 22 | 10 |
| Representatives.... | 1 | 3 | 5 |
| | 33 | 25 | 15 |
| AUSTRALIAN. | | | |
| Species ..... | 4 | 5 | 10 |
| Representatives.... | 3 | 9 | 26 |
| | 7 | 14 | 36 |

This table shows how two streams of immigration have entered the islands, the one from Java diminishing in intensity as it flowed on to Timor, the other from Australia diminishing in about the same degree towards Lombock. The total number of species which have entered on the two sides seems nearly equal, with only a slight preponderance in favour of Australia; but there is this remarkable difference, that whereas the great majority of the species derived from Java are identical with the present inhabitants of that island, those derived from Australia are for the most part representative species, less than half of them being identical with birds still living in that country. We shall see this perhaps more clearly by treating the islands as a whole, and dividing that portion of their birds which have exclusive relations to Java or Australia in a similar manner; thus the Timorese avifauna contains

| | | | |
|---|---|---|---|
| Javan species..... | 35 | Australian species..... | 13 |
| Javan representatives.. | 11 | Australian representatives.. | 35 |
| | 46 | | 48 |

showing that, though the total number of species derived from the two districts is nearly the same, the identical species and representatives are divided in exactly reverse proportions. This fact is one of the most important that we can draw from a consideration of these lists of species, since it gives us a clue to the manner in which this little group of islands was first stocked with animal life, and, in connexion with geological considerations, will enable us to form a general idea of their early history.

Change of species is a slow process. On that we are all agreed, though we may differ about how it has taken place. The fact that the Australian species in these islands have mostly changed, while the Javan species have almost all remained unchanged, would therefore indicate that the district was first peopled from Australia. But, for this to have been the case, the physical conditions must have been very different from what they are now. Nearly 300 miles of open sea now separates Australia from Timor, which island is con-

nected with Java by a chain of broken land divided by straits which are nowhere more than about twenty miles wide. Evidently there are now great facilities for the natural productions of Java to spread over and occupy the whole of these islands, while those of Australia would find very great difficulty in getting across. To account for the present state of things, we should naturally suppose that Australia was once much more closely connected with Timor than it is at present; and that this was the case is rendered highly probable by the fact of a submarine bank extending along all the north and west coast of Australia, and at one place approaching within twenty miles of the coast of Timor. This indicates a recent subsidence of North Australia, which probably once extended as far as the edge of this bank. I do not think Timor was ever absolutely connected with Australia, because the representation of the forms of that country is not sufficiently perfect. There are no Kangaroos in Timor, nor indeed any Marsupials whatever, except a *Cuscus*, which is a Moluccan and not an Australian genus. Many highly characteristic genera of birds are also absent which we should certainly expect to find had the countries ever been connected, such as *Calyptorhynchus*, *Malurus*, *Cracticus*, *Anthochæra*, *Poëphila*, *Falcunculus*, *Colluricincla*, &c. Nor do any of the characteristic Australian groups of insects occur in Timor. Everything indicates therefore that a strait of the sea has always separated it from Australia—a supposition which is confirmed by the deep gulf that still runs between its rocky southern coast and the edge of the before-mentioned submarine bank.

But at the time when this narrowing of the sea took place in one direction, there must have been a greater separation at the other end of the chain, or we should find more equality in the numbers of identical and representative species derived from each extremity. It is true that the widening of the strait at the Australian end by subsidence would, by putting a stop to immigration and intercrossing of individuals from the mother country, have allowed the full action of the causes which have led to the modification of the species; while the continued stream of immigrants from Java would by continual intercrossing check such modification. This view will not, however, explain all the facts; for the character of the fauna of the Timorese group is indicated as well by the forms which are absent from it as by those which it contains, and is by this kind of evidence shown to be much more Australian than Indian. No less than twenty-nine genera, all more or less abundant in Java, and most of which range over a wide area, are quite absent; while of the equally diffused Australian genera only about fourteen are wanting. This would clearly indicate that there has been till recently a wide separation from Java; and the fact that the islands of Baly and Lombock are small and are almost wholly volcanic, and contain a smaller number of modified forms than the other islands, would point them out as of comparatively recent origin. Here probably existed a wide arm of the sea at the time when Timor was in the closest proximity to Australia; and as the subterranean fires were slowly piling up the now fertile islands of Bali and Lombock, the northern shores of

Australia would be sinking beneath the ocean. Some such changes as these will enable us to understand how it happens that, though the birds of these islands are on the whole almost as much Indian as Australian, yet the apparently endemic species have such a preponderating Australian character, and why such a very large number of characteristic Indian forms, which are common in Java and are known in most instances to extend into Bali, have yet never transmitted a single representative to the islands further east.

The following is a list of all the birds known to inhabit this group, with their distribution in the several islands. Those marked with an * are not known from any other localities. The descriptions of twenty-eight new species are afterwards given.

| | | Lombock. | Flores. | Timor. |
|---|---|---|---|---|
| 1. | Baza reinwardtii, *Schl. & Müll.* .... | ..... | ..... | B. reinwardtii. |
| 2. | Haliastur ponticerianus, *Gm.* ..... | ..... | H. ponticerianus .. | H. ponticerianus. |
| 3. | Nisus virgatus, *Cuv.* ..... | ..... | ..... | N. virgatus. |
| 4. | Accipiter cruentus, *Gould* ..... | ..... | ..... | A. cruentus. |
| 5. | —— approximans, *Vig. & Horsf.*.... | A. approximans .. | A. approximans. | ..... |
| 6*. | —— sylvestris, *Wall.* ..... | ..... | A. sylvestris. | ..... |
| 7*. | —— n. sp. (*Gurney*), immature .... | A. ——, sp. | ..... | ..... |
| 8. | Milvus affinis, *Gould* ..... | ..... | ..... | M. affinis. |
| 9. | Hypotriorchis frontatus, *Gould* .... | ..... | H. frontatus. | ..... |
| 10. | Tinnunculus moluccensis, *H. & J.* .. | ..... | T. moluccensis.... | T. moluccensis. |
| 11*. | Athene guteruhi, *Müll.*..... | ..... | ..... | A. guteruhi. |
| 12*. | —— florensis, *Wall.* ..... | ..... | A. florensis. | ..... |
| 13. | Scops menadensis, var., *Q. & G.* .... | ..... | S. menadensis. | ..... |
| 14*. | —— sylvicola, *Wall.*..... | ..... | S. sylvicola. | ..... |
| 15. | Strix javanica, *Horsf.* ..... | S. javanica. | ..... | ..... |
| 16*. | Geoffroyus jukesii, *G. R. G.*? ..... | ..... | G. jukesii ..... | G. jukesii. |
| 17*. | Loriculus flosculus, *Wall.*..... | ..... | L. flosculus. | ..... |
| 18*. | Aprosmictus vulneratus, *Wagl.* .... | ..... | ..... | A. vulneratus. |
| 19*. | Trichoglossus hæmatodus, *L.* ..... | ..... | ..... | T. hæmatodus. |
| 20*. | —— euteles, *Temm.* ..... | ..... | T. euteles ..... | T. euteles. |
| 21*. | —— iris, *Temm.* ..... | ..... | ..... | T. iris. |
| 22*. | —— forsteni, *Bp.* (Sumbawa). | ..... | ..... | ..... |
| 23. | Cacatua sulphurea, *Gm.* ..... | C. sulphurea .... | C. sulphurea .... | C. sulphurea. |
| 24. | Halcyon collaris, *Sw.* ..... | H. collaris ..... | H. collaris ..... | H. collaris. |
| 25. | —— coronatus, *Müll.* ..... | H. coronatus .... | ..... | H. coronatus. |
| 26. | —— sanctus, *Vig. & Horsf.* ..... | H. sanctus. | ..... | ..... |
| 27. | —— leucocephalus, *Gm.* ..... | H. leucocephalus.. | H. leucocephalus. | ..... |
| 28*. | —— fulgidus, *Gould* ..... | H. fulgidus ..... | H. fulgidus. | ..... |
| 29. | Alcedo moluccensis, *Blyth* ..... | ..... | A. moluccensis. | ..... |
| 30. | —— meningting, *Horsf.* ..... | A. meningting. | ..... | ..... |
| 31. | —— biru, *Horsf.* ..... | A. biru. | ..... | ..... |
| 32. | Ceyx rufidorsa, *Strick.*..... | C. rufidorsa ..... | C. rufidorsa. | ..... |
| 33. | Caprimulgus macrourus, *Horsf.* .... | C. macrourus .... | ..... | C. macrourus. |
| 34. | Collocalia esculenta, *L.* ..... | ..... | ..... | C. esculenta. |
| 35. | —— fuciphaga, *Thunb.* ..... | ..... | ..... | C. fuciphaga. |
| 36. | Merops javanicus, *Horsf.* ..... | ..... | M. javanicus .... | M. javanicus. |
| 37. | —— ornatus, *Lath.* ..... | M. ornatus ..... | M. ornatus. | ..... |
| 38. | Eurystomus pacificus, *Gm.* ..... | E. pacificus ..... | E. pacificus ..... | E. pacificus. |
| 39. | Cuculus canoroides, *Müll.* ..... | ..... | C. canoroides .... | C. canoroides. |
| 40*. | —— lepidus, *Müll.* ..... | ..... | ..... | C. lepidus. |
| 41. | Cacomantis tymbonomus, *Müll.* .... | ..... | ..... | C. tymbonomus. |
| 42. | Chrysococcyx chalcites, *Ill.* ..... | C. chalcites ..... | C. chalcites ..... | C. chalcites. |

| | Lombock. | Flores. | Timor. |
|---|---|---|---|
| Eudynamis australis, *Sw.* | E. australis | E. australis | E. australis. |
| Centropus affinis, *Horsf.* | C. affinis | C. affinis | C. affinis. |
| Scythrops novæ-hollandiæ, *Reinw.* | ..... | S. novæ-hollandiæ. | ..... |
| Picus moluccensis, *Gm.* | P. moluccensis | P. moluccensis. | ..... |
| Pitta concinna, *Gould* | P. concinna | P. concinna. | ..... |
| —— irena, *Temm.* | ..... | ..... | P. irena. |
| Zoothera andromeda, *Temm.* | Z. andromeda. | ..... | ..... |
| Drymocataphus bivittatus, *Bp.* | ..... | ..... | D. bivittatus. |
| Pycnonotus analis, *Horsf.* | P. analis. | ..... | ..... |
| Oriolus broderipi, *Bp.* | O. broderipi | O. broderipi. | ..... |
| Mimeta viridifusca, *Cab.* | ..... | ..... | M. viridifusca. |
| Sphecothera viridis, *Q. & G.* | ..... | ..... | S. viridis. |
| Parus cinereus, *Vieill.* | P. cinereus | P. cinereus. | ..... |
| Mirafra javanica, *Horsf.* | ..... | M. javanica. | ..... |
| Anthus medius, *Wall.* | A. medius | ..... | A. medius. |
| Motacilla flavescens, *Shaw* | ..... | M. flavescens | M. flavescens. |
| Geocichla interpres, *Kuhl.* | G. interpres. | ..... | ..... |
| —— rubiginosa, *Müll.* | ..... | ..... | G. rubiginosa. |
| Turdus schlegelii, *Sclat.* | ..... | ..... | T. schlegelii. |
| Acrocephalus orientalis, *Bp.* | A. orientalis. | ..... | ..... |
| Megalurus timoriensis, *Wall.* | ..... | ..... | M. timoriensis. |
| Cisticola fuscicapilla, *Wall.* | ..... | C. fuscicapilla | C. fuscicapilla. |
| —— ruficeps, *Gould* | C. ruficeps | C. ruficeps | C. ruficeps. |
| —— lineocapilla, *Gould* | C. lineocapilla. | ..... | ..... |
| Orthotomus sepium, *Horsf.* | O. sepium. | ..... | ..... |
| Sylvia flavescens, *G. R. G.* | ..... | S. flavescens | S. flavescens. |
| Gerygone sulphurea, *Wall.* | ..... | G. sulphurea. | ..... |
| —— inornata, *Wall.* | ..... | ..... | G. inornata. |
| Pratincola caprata, *L.* | P. caprata | P. caprata | P. caprata. |
| Saxicola dumetoria, *Wall.* | S. dumetoria. | ..... | ..... |
| —— luctuosa, *Bp.* | ..... | ..... | S. luctuosa. |
| —— pyrrhonota, *Bp.* | ..... | ..... | S. pyrrhonota. |
| —— melanoleuca, *Bp.* | ..... | ..... | S. melanoleuca. |
| Muscipeta affinis, *Hay*, var. | ..... | M. affinis, var. | ..... |
| Myiagra cærulea, *Gm.*, var. | ..... | M. cærulea. | ..... |
| —— rufigula, *Wall.* | ..... | ..... | M. rufigula. |
| Micrœca superciliosa, *Wall.* | ..... | ..... | M. superciliosa. |
| Rhipidura diluta, *Wall.* | ..... | R. diluta. | ..... |
| —— ochrogastra, *Müll.* | ..... | ..... | R. ochrogastra. |
| —— semicollaris, *Müll.* | ..... | ..... | R. semicollaris. |
| Monarcha cinerascens, *Temm.* | ..... | ..... | M. cinerascens. |
| —— trivirgata, *Temm.* | ..... | ..... | M. trivirgata. |
| —— carinata, *Vig. & Horsf.* | ..... | ..... | M. carinata. |
| Cyornis hyacinthina, *Temm.* | ..... | ..... | C. hyacinthina. |
| Hirundo javanica, *Sparrm.* | H. javanica | ..... | H. javanica. |
| —— striolata, *Temm.* | ..... | H. striolata. | ..... |
| —— nigricans, *Vieill.* | ..... | H. nigricans | H. nigricans. |
| Artamus leucogaster, *Val.* | A. leucogaster | A. leucogaster | A. leucogaster, var. |
| —— perspicillatus, *Temm.* | ..... | ..... | A. perspicillatus. |
| Dicrourus bimaënsis, *Wall.* | D. bimaënsis | D. bimaënsis. | ..... |
| —— densus, *Temm.* | ..... | ..... | D. densus. |
| —— cineraceus, *Horsf.* | D. cineraceus. | ..... | ..... |
| Graucalus personatus, *Müll.* | ..... | G. personatus | G. personatus. |
| —— melanogenys, *H. & J.* | ..... | ..... | G. melanogenys. |
| Campephaga plumbea, *Müll.* | ..... | ..... | C. plumbea. |
| Lalage leucophæa, *Vieill.* | L. leucophæa | ..... | L. leucophæa. |
| —— nychthemera, *Bp.* | ..... | ..... | L. nychthemera. |
| Pericrocotus exul, *Wall.* | P. exul. | ..... | ..... |

| | Lombock. | Flores. | Timor. |
|---|---|---|---|
| 101. Pachycephala grisola, *Bl.*, var. .... | P. grisola. | ..... | ..... |
| 102*. —— orpheus, *Jard.* ..... | ..... | ..... | P. orpheus. |
| 103*. —— calliope, *Müll.* ..... | ..... | ..... | P. calliope. |
| 104*. —— fulvotincta, *Wall.* ..... | ..... | P. fulvotincta. | ..... |
| 105*. Pardalotus obsoletus, *Müll.* ..... | ..... | P. obsoletus ..... | P. obsoletus. |
| 106. Lanius schah, *L.* ..... | L. schah ..... | ..... | L. schah. |
| 107. Corvus macrorhynchus, *Wagl.* ..... | C. macrorhynchus . | C. macrorhynchus . | C. macrorhyn |
| 108*. Tropidorhynchus timoriensis, *Müll.* . | T. timoriensis .... | T. timoriensis .... | T. timoriensi |
| 109*. —— cineraceus, *Temm.* ..... | ..... | ..... | T. cineraceus |
| 110*. Ptilotis limbata, *Müll.* ..... | P. limbata ..... | P. limbata ..... | P. limbata. |
| 111*. —— virescens, *Wall.* ..... | P. virescens. | ..... | ..... |
| 112*. —— maculata, *Müll.* ..... | ..... | ..... | P. maculata. |
| 113*. —— reticulata, *Müll.* ..... | ..... | ..... | P. reticulata. |
| 114. Glycyphila ocularis, *Gould* ..... | ..... | ..... | G. ocularis. |
| 115*. Myzomela vulnerata, *Müll.* ..... | ..... | ..... | M. vulnerata |
| 116. Zosterops intermedia, *Wall.* ..... | Z. intermedia. | ..... | ..... |
| 117*. —— aureifrons, *Wall.* ..... | ..... | Z. aureifrons. | ..... |
| 118*. —— citrinella, *Müll.* ..... | ..... | ..... | Z. citrinella. |
| 119*. Dicæum macklotti, *Müll.* ..... | D. macklotti .... | ..... | D. macklotti. |
| 120*. —— igniferum, *Wall.* ..... | ..... | D. ignifer. | ..... |
| 121. Nectarinia pectoralis, *Horsf.* ..... | N. pectoralis .... | N. pectoralis. | ..... |
| 122*. —— solaris, *Temm.* ..... | ..... | N. solaris ..... | N. solaris. |
| 123. Anthreptes lepida, *Lath.* ..... | ..... | A. lepida. | ..... |
| 124*. Calornis minor, *Bp.* ..... | C. minor ..... | C. minor ..... | C. minor. |
| 125*. Gracula venerata, *Bp.* ..... | ..... | G. venerata. | ..... |
| 126. Munia oryzivora, *L.* ..... | M. oryzivora. | ..... | ..... |
| 127*. —— pallida, *Wall.* ..... | M. pallida ..... | M. pallida. | ..... |
| 128*. —— quinticolor, *Vieill.* ..... | M. quinticolor.... | M. quinticolor.... | M. quinticol |
| 129. —— fuscata, *Vieill.* ..... | ..... | ..... | M. fuscata. |
| 130. —— ferruginea, *Sparrm.* ..... | ..... | M. ferruginea. | ..... |
| 131. —— punctularia, *L.* ..... | M. punctularia .. | M. punctularia .. | M. punctula |
| 132. —— molucca, *L.* ..... | ..... | M. molucca. | ..... |
| 133*. Amadina insularis, *Wall.* ..... | ..... | A. insularis ..... | A. insularis. |
| 134*. Estrelda flavidiventris, *Wall.* ..... | ..... | E. flavidiventris .. | E. flavidiven |
| 135*. Erythrura tricolor, *Vieill.* ..... | ..... | ..... | E. tricolor. |
| 136*. Treron floris, *Wall.* ..... | ..... | T. floris. | ..... |
| 137*. —— psittacea, *Temm.* ..... | ..... | ..... | T. psittacea. |
| 138. Carpophaga ænea, *L.* ..... | C. ænea ..... | C. ænea. | ..... |
| 139. —— rosacea, *Temm.* ..... | ..... | C. rosacea..... | C. rosacea. |
| 140*. —— cineracea, *Temm.* ..... | ..... | ..... | C. cineracea. |
| 141. Ptilonopus melanocephalus, *L.* .... | P. melanocephalus. | P. melanocephalus. | ..... |
| 142*. —— flavicollis, *Gray* ..... | ..... | ..... | P. flavicollis |
| 143*. —— cinctus, *Temm.* ..... | ..... | ..... | P. cinctus. |
| 144*. —— albocinctus, *Wall.* ..... | ..... | P. albocinctus. | ..... |
| 145*. Ianthœnas metallica, *Temm.* ..... | ..... | ..... | I. metallica. |
| 146. Turtur tigrina, *Temm.* ..... | T. tigrina ..... | T. tigrina ..... | T. tigrina. |
| 147. —— bitorquata, *Temm.* ..... | T. bitorquata .... | T. bitorquata .... | T. bitorquat |
| 148. Macropygia æmiliana, *Bp.* ..... | M. æmiliana. | ..... | ..... |
| 149*. —— magna, *Wall.* ..... | ..... | ..... | M. magna. |
| 150*. Turacœna modesta, *Temm.* ..... | ..... | ..... | T. modesta. |
| 151. Geopelia striata, *L.* ..... | G. striata. | ..... | ..... |
| 152*. —— maugei, *Temm.* ..... | ..... | G. maugei ..... | G. maugei. |
| 153. Chalcophaps javanica, *Gm.* ..... | C. javanica ..... | C. javanica. | ..... |
| 154*. Chalcophaps timoriensis, *Bp.* ..... | ..... | ..... | C. timoriens |
| 155. Gallus bankiva, *Temm.* ..... | G. bankiva ..... | ..... | G. bankiva. |
| 156. —— furcatus, *Temm.* ..... | G. furcatus ..... | G. furcatus. | ..... |
| 157*. Coturnix raaltenii, *Müll.* ..... | ..... | C. raaltenii ..... | C. raaltenii. |
| 158*. Hemipodius rufescens, *Wall.* ..... | ..... | ..... | H. rufescens |

| | Lombock. | Flores. | Timor. |
|---|---|---|---|
| Megapodius reinwardti, *Wagl.* | M. reinwardti | M. reinwardti. | ..... |
| Charadrius longipes, *Temm.* | ..... | C. longipes | C. longipes. |
| —— leschenaultii, *Pall.* | ..... | C. leschenaultii. | ..... |
| Totanus hypoleucus, *Temm.* | ..... | T. hypoleucus | T. hypoleucus. |
| —— glareola, *Gm.* | ..... | ..... | T. glareola. |
| Numenius uropygialis, *Gould* | ..... | N. uropygialis. | ..... |
| Scolopax horsfieldi, *Gray* | ..... | ..... | S. horsfieldi. |
| Himantopus leucocephalus, *Gould* | ..... | ..... | H. leucocephalus. |
| Ardea typhon, *Temm.* | ..... | A. typhon. | ..... |
| Egretta immaculata, *Gould* | ..... | E. immaculata. | ..... |
| —— syrmatophora, *Gould* | ..... | ..... | E. syrmatophora. |
| —— nigrirostris, *Gray* | ..... | ..... | E. nigrirostris. |
| Herodias coromanda, *Bodd.* | ..... | ..... | H. coromanda. |
| —— jugularis, *Blyth* | ..... | ..... | H. jugularis. |
| —— novæ-hollandiæ, *Lath.* | ..... | ..... | H. novæ-hollandiæ. |
| Butorides javanica, *Horsf.* | ..... | B. javanica | B. javanica. |
| Ardeola sinensis, *Gm.* | ..... | A. sinensis. | ..... |
| Rallina phœnicura, *Temm.* | ..... | ..... | R. phœnicura. |
| —— philippensis, *L.* | ..... | ..... | R. philippensis. |
| Porzana quadristrigata, *Horsf.* | ..... | ..... | P. quadristrigata. |
| Gallinula orientalis, *Horsf.* | G. orientalis. | ..... | ..... |
| —— frontata, *Wall.* | ..... | G. frontata. | ..... |
| Porphyrio smaragdinus, *Temm.* | ..... | ..... | P. smaragdinus. |
| Anas gibbifrons, *Müll.* | ..... | A. gibbifrons | A. gibbifrons. |
| —— superciliosa, *Gould* | ..... | ..... | A. superciliosa. |
| Dendrocygna vagans, *Eyton* | ..... | ..... | D. vagans. |
| Podiceps tricolor, *G. R. G.* | ..... | P. tricolor | P. tricolor. |
| Graculus melanoleucus, *Vieill.* | ..... | ..... | G. melanoleucus. |
| | 63 species. | 86 species. | 118 species. |

ACCIPITER SYLVESTRIS.

*Cinereus, capite pallidiore, gula pallide rufescente, pectore et abdomine rufis anguste albo fasciatis, alis subtus et tectricibus caudæ inferioribus albescentibus, rectricibus ad basin albis plus minusve nigro fasciatis.*

Ashy above, rufous beneath, narrowly banded with whitish; wings white on the under surface, except the ends of the quills; tail white at the base, and the feathers towards the centre with eight or nine blackish bands. This bird resembles *A. iogaster* in wanting the rufous collar, but is much smaller and paler-coloured; it is also like *A. cruentus* in its banded under surface, but, though smaller, has a larger bill than that species. Bill black; cere and legs yellow.

♂. Total length 12½ inches; wings 7 inches; tail 5½ inches.

♀. Total length 13¾ inches; wing 8 inches; tail 6¼ inches.

*Hab.* Flores.

SCOPS SILVICOLA.

*Rufo-fuscus, plumis nigro lineatis et maculatis; tectricibus alarum albo marginatis; remigibus fuscis, fasciis plurimis externe pallide rufis, interne obsoletis; cauda obscura, rufo irrorata, fasciis decem rufis; tarsis dense vestitis, digitis nudis.*

Pale dusky rufous, the feathers irrorated with dusky and with a median dark line; greater and middle wing-coverts white-tipped; quills dusky, with obsolete paler bands, on the outer web with pale rufous bands; tail with about ten narrow rufous bands, which are dusky-margined; facial setæ very long; tarsi densely feathered; toes naked.

Total length 12 inches; wing $8\frac{1}{2}$ inches; tail $4\frac{1}{2}$ inches; bill, from gape, $1\frac{1}{10}$ inch.

*Hab.* Flores.

*Remark.*—The only specimen obtained was immature; but it seems very distinct from all other Malayan species.

ATHENE FLORENSIS.

*Fusco-brunnea, subtus alba, brunneo maculato-striata; fronte gulaque albescentibus; cauda fasciis quinque obscurioribus, rectricibus albo terminatis.*

Darker and much larger than the other Malayan forms of *Athene hirsuta*.

Total length $12\frac{3}{4}$ inches; wing $9\frac{1}{4}$ inches; tail $5\frac{1}{4}$ inches; tarsus and mid toe, without claw, $2\frac{1}{4}$ inches; bill, from gape, 1 inch.

*Hab.* Flores.

LORICULUS FLOSCULUS.

*Viridis, dorso obscuriore; macula gulari, uropygio tectricibusque caudæ superioribus coccineis; macula nuchali fulvescente; alis caudaque subtus glauco-viridibus, rectricibus flavo terminatis.*

Green, above darker; middle of the body beneath with a yellowish tinge; nape fulvous orange; elongate spot on throat red, rump and upper tail-coverts crimson; tail above dark green tipped with yellow and red; quills and tail-feathers beneath margined with verditer-blue; bill red; feet orange-red.

Total length $4\frac{3}{4}$ inches; wing 3 inches.

*Hab.* Flores.

*Remarks.*—This pretty little bird is allied to the *L. pusillus* of Java and *L. indicus* of Ceylon; but also approaches in coloration to *L. galgulus* and others of the black-billed group. A single specimen only was obtained.

ANTHUS MEDIUS.

A. australi *similis, sed minor, ungue postico magis curvato : similis* A. malayano, *sed rostro breviore, pectoris striis majoribus, ungue postico breviore et magis curvato.*

Dusky or blackish above; the feathers margined with ochreish yellow or ashy, beneath white or yellowish; the breast and a line from each angle of the mouth dusky-spotted; a yellowish line above the eye; tail dusky, outer feather white, except the base, the next dusky on the inner margin; bill blackish horn, beneath yellowish; feet very pale; iris dark.

Total length 6¾ inches; wing 3⅛ inches; tail 2½ inches; bill, to front, $\frac{7}{12}$ inch.

*Hab.* Timor and Lombock.

DRYMOCATAPHUS BIVITTATUS, Bp. (Consp. Gen. Av. p. 359).

*Olivaceo-brunneus, subtus pallide rufescens, capite saturatiore, uropygio caudaque rufo-castaneis, vitta supra oculos pallide rufa, alis ventre et lateribus fuscis, tectricibus caudæ inferioribus rufis.*

Above olive-brown, on head chestnut-tinged, on rump and tail deep chestnut-brown, a stripe over the eye widening to the nape pale rufous; beneath rufescent; wings and flanks dusky; belly paler; under tail-coverts rufous; bill dark olive, pale beneath; iris dark; feet pale olive.

Total length 7¼ inches; wing 2½ inches; tail 3¼ inches; bill, to gape, ⅞ inch.

*Hab.* Timor.

*Remarks.*—The sexes are alike. This bird is closely allied to the *Myiothera capistrata*, Temm.; but differs in its coloration, and in having a much longer tail. I had described it as a new species, but have now little doubt that it is the bird briefly characterized by Bonaparte as *Napothera bivittata*.

MEGALURUS TIMORIENSIS.

*Similis* M. galactodi (Temm.), *sed major et cauda immaculata.*

Above rusty rufous; the feathers of the back, tertiaries, and greater wing-coverts having dark centres and dusky yellowish margins; beneath whitish; throat pure white; sides of the neck and breast of an ashy tinge, which becomes a pale brown on the flanks and under tail-coverts; a pale streak from the nostrils above the eye; under wing-coverts rufous-tinged; bill bluish, pale below, and blackish on the culmen; feet pale olive.

Total length 9 inches; wing $1\frac{7}{10}$ inch; bill, to front, ½ inch; tarsus 1 inch; mid toe and claw 1 inch.

*Hab.* Timor.

*Remarks.*—The sexes are alike. This bird carries its tail much elevated. It seems to be a large and slightly modified race of the Australian *M. galactodes*.

CISTICOLA FUSCICAPILLA.

*Supra rufo-brunnea, subtus alba dilute fulvo tincta; dorso alisque fuscis, plumis pallide marginatis; uropygio rufescente; rectricibus fuscis medialiter rufo maculatis, versus apicem nigro fasciatis, et albo terminatis.*

Above dusky brown; back and wings dusky, with the feathers brown-margined; wing-coverts and quills margined with light brown; beneath white, very faintly buff-tinged; rump and flanks buffy; tail dusky, all the lateral feathers with a rufous band beyond the middle,

more distinct on the inner web, beyond this a subterminal black band and white apex; under wing-coverts white; bill pale yellowish, dusky above; feet pale reddish.

Total length 4 inches; wing 2 inches; bill, to gape, $\frac{1}{2}$ inch.

*Hab.* Timor; Flores.

*Remark.*—This species is near *C. ruficeps*, Gould, but differs in the dark head and peculiar markings of the tail.

SAXICOLA (?) DUMETORIA.

*Nigra; gula et pectore rufis; abdomine et tectricibus caudæ inferioribus albis; fascia longitudinali alarum et linea elongata supra-oculari albis; rectricibus dimidio basali albo, duabus mediis exceptis nigris.*

Shining black; throat and breast light rufous, remaining under parts white; chin whitish, a line from above the nostrils over the eye to the back of the head white; tips of the middle wing-coverts and the outer web of the third tertiary white, forming a white longitudinal band across the wing; two middle tail-feathers all black, the next two black-edged at the base, and the rest with the basal half entirely white; bill black; feet pale.

Total length $5\frac{1}{8}$ inches; wing $2\frac{7}{12}$ inches; tail $1\frac{9}{10}$ inch; bill, from gape, $\frac{6}{10}$ inch.

*Hab.* Lombock.

*Remark.*—The genus to which this bird belongs is doubtful. It is, however, congeneric with *Saxicola pyrrhonota*, Müll., from Timor.

GERYGONE INORNATA.

*Supra pallide fusca, subtus alba; alis fuscis, remigibus albo lituratis; cauda fusca, basi albescente, versus apicem nigra, rectricibus albo terminatis, duabus externis macula apicali fusca.*

Above pale earthy brown; beneath white; quills dusky, white-edged; tail dusky, whitish at the base, toward the end black, each feather terminated with a white spot, which on the two outer ones is larger and bears a dusky spot at the apex; bill and feet black; iris red. The sexes are alike.

Total length 4 inches; wing 2 inches; tail $1\frac{3}{4}$ inch; bill, to front, $\frac{1}{3}$ inch.

*Hab.* Timor.

GERYGONE SULPHUREA.

*Supra dilute olivaceo-cinerea, subtus sulphurea; remigibus fuscis pallide marginatis; rectricibus fascia subterminali nigra, in pogonio interno albo terminata.*

Pale ashy, with a faint olive tinge; beneath pure sulphur-yellow, becoming whitish on the under tail-coverts; quills dusky, with an outer pale edge and whitish inner margin; tail with a subterminal blackish band, beyond which is a white spot on the inner web; bill broad, black; feet dusky plumbeous.

Total length $3\frac{2}{3}$ inches; wing $1\frac{7}{8}$ inch; tail $1\frac{4}{10}$; bill, to front, $\frac{1}{3}$ inch.

*Hab.* Solor Island.

GERYGONE SUPERCILIOSA.

*Olivaceo-viridis, subtus albo-flavescens; capite obscuriore, genis et linea superciliari albescentibus; cauda fusca, viridi marginata, rectricibus utrinque tribus pogonio interno albo.*

Olivaceous; head dusky; beneath yellow-white; throat whitish, yellow-dashed; a whitish line over the eye from the nostrils to the nape; quills dusky, olive-margined; tail dusky, the middle feathers olive-margined, the outer three on each side white, narrowly margined with dusky and an olive edge; bill dusky, beneath yellowish; feet lead-colour.

Total length $4\frac{1}{4}$ inches; wing $2\frac{1}{8}$ inches; tail $1\frac{3}{4}$ inch; bill, to front, $\frac{4}{10}$ inch.

*Hab.* Timor.

MYIAGRA RUFIGULA.

*Cyaneo-plumbea; capite cyaneo-chalybeo; gula et pectore intense rufo-castaneis, abdomine albo; cauda fusco-nigra, rectricibus duabus extimis externe albo marginatis.*

Lead-blue; head steel-blue; throat and breast vivid chestnut-red; belly and under tail-coverts white; quills blackish, very narrowly bluish-margined towards the base; under wing-coverts white, and quills white-margined towards the base beneath; tail blackish, the outer margin of the two outer feathers and the extreme tips of the next pair whitish; bill lead-blue, tip and culmen black; iris dark; feet black.

Total length 6 inches; wing $2\frac{3}{4}$ inches; bill, from front, $\frac{1}{2}$ inch, width $\frac{3}{10}$ inch.

*Hab.* Timor.

*Remark.*—This species differs from *M. latirostris*, Gould, in its smaller size, more deeply coloured throat, and the white margin to the outer tail-feathers.

RHIPIDURA DILUTA.

*Fusca; fronte caudaque fusco-nigra; gula et macula utrinque ante oculos albis, pectore rufo-fusco; abdomine tectricibusque caudæ inferioribus dilute rufis, rectricibus duabus utrinque et apice tertiæ albo-ochraceis.*

Dusky brown; forehead and tail blackish; throat and a small frontal eye-mark white; breast rufous ashy, rest beneath pale rufous; two outer tail-feathers and the outer and apical portion of the third ochreish white; quills dusky, narrowly margined with bright rufous; bill black, base of lower mandible and basal half of its vibrissæ pale; iris dark; feet dusky.

Total length $6\frac{1}{2}$ inches; wing 3 inches; tail $3\frac{1}{4}$ inches.

*Hab.* Flores.

*Remark.*—Near to *R. assimilis*, G. R. Gray, but may be at once distinguished from all the other species of the genus by the uniform pale colour of the outer tail-feathers.

PACHYCEPHALA FULVOTINCTA.

*Supra flavo-olivacea, subtus cum cervice lutea, pectore fulvo tincta; capite et torque lato gulari nigris, gula alba, cauda cum tectricibus superioribus nigris.*

Above olive-yellow; beneath yellow; head and a band across the throat black; chin and throat white; upper part of breast rich fulvous yellow; a yellow collar round the nape, brightest on the sides of the neck; quills dusky, olive-margined; upper tail-coverts and tail black, feathers narrowly tipped with olive.

♀. Above dusky olivaceous; crown ashy; rump and tail yellowish; quills dusky, margined with brown, the tertiaries with rufous; beneath, cheeks and breast rufescent; chin whitish; lower breast and belly nearly pure white; under tail-coverts pale yellow; bill black; feet dusky.

Total length 6 inches; wing 3 inches; tail $2\frac{1}{3}$ inches.

*Hab.* Flores.

DICROURUS BIMAËNSIS.

*Edolius bimaënsis*, Temm. MSS. (Bp. Consp. p. 352).

*Nigro-cæruleus; alis caudaque æneo-viridibus, metallicis; pectore maculis elongatis metallicis; caudæ rectricibus externis valde recurvatis.*

Blue-black; wings and tail brilliant metallic brassy green; elongate spots on the breast and the tips of the feathers of the crown of the same colour; the outer tail-feathers strongly curved upwards; frontal feathers much elongated and depressed; bill and feet black; iris red.

Total length 11 inches; wing $5\frac{1}{4}$ inches; tail 5 inches; bill, from gape, 1·4 inch.

*Hab.* Lombock, Sumbawa (*Temm.*), and Flores.

*Remark.*—The name above quoted has no description attached to it in Bonaparte's 'Conspectus;' but I have adopted it for this bird, which is no doubt the same species.

PERICROCOTUS EXUL.

*Nigro-cæruleus; pectore, ventre, uropygio, fascia alarum et rectricibus lateralibus vivide aurantiacis, rectricibus duabus mediis nigris, duabus sequentibus dimidio apicali aurantiaco.*

♀. *Coloribus cinereis et flavis similiter dispositis, et fronte flavescente.*

Blue-black; breast, belly, rump, upper and under tail-coverts, margin of shoulder, wing-band, and outer tail-feathers rich orange; the wing has a band from the fourth primary, narrowing on the secondaries, and suddenly broader on the tertiaries, and two of the

tertiaries have an orange spot near the tip; the tail has the two middle feathers entirely black, the next two with half the outer and one-third the inner web orange, the rest orange with a decreasing quantity of black at their bases. The female is dusky ash; the wings and tail blackish, with a bright yellow taking the place of the orange in the male; the forehead is yellow-tinged, and the quills are more or less margined and tipped with yellow; bill and feet black; iris dark.

Total length $7\frac{1}{2}$ inches; wing $3\frac{1}{4}$ inches; tail $3\frac{5}{8}$ inches; bill, to front, $\frac{1}{2}$ inch.

*Hab.* Lombock.

*Remark.*—This elegant species differs from *P. flammeus*, Temm., in its larger size, orange colour, and rather different markings of the wings and tail.

ZOSTEROPS INTERMEDIA.

*Flavo-virescens, subtus flava; fronte flavescente, tænia nigra sub oculis; remigibus rectricibusque fuscis, flavo-viridi marginatis.*

Very near *Z. flava*, but a little larger, more yellow on the forehead and less on the upper tail-coverts, and the black subocular streak not extending so far forward; iris olive-brown; feet dusky lead; upper mandible dark, lower pale.

Total length $4\frac{1}{2}$ to $4\frac{3}{4}$ inches; wing $2\frac{1}{5}$ inches; bill, to gape, $\frac{6}{10}$ inch.

*Hab.* Macassar and Lombock.

*Remark.*—Mr. G. R. Gray attached the MS. name of *intermedius* to my Macassar specimen.

ZOSTEROPS AUREIFRONS.

*Flavo-virescens, subtus alba, lateribus albo-cinereis; facie, gula, uropygio et crisso vivide flavis; frontis plumis densis, suberectis, aureo-fulvis.*

Greenish yellow; head yellower; forehead golden orange; face, throat, rump, and under tail-coverts pure yellow; beneath the body white, with the sides ashy; wings and tail dusky, feathers margined with olive-yellow; iris dark; bill dusky lead; feet pale lead-colour.

Total length $4\frac{1}{4}$ inches; wing $2\frac{1}{8}$ inches.

*Hab.* Flores.

I give here descriptions of two other species of *Zosterops* which appear new:—

ZOSTEROPS ATRIFRONS.

*Flavo-virescens, capite obscuriore, fronte nigra, pectore cinereo-albo, abdomine albo, tectricibus caudæ inferioribus flavis, cauda fusco-nigra.*

Greenish yellow; top of head dusky, shading into deep black on the forehead and the space in front of the eye; breast ashy white;

belly white; under tail-coverts yellow; tail dusky black; quills dusky, yellow-margined; bill black, base beneath lead-colour; feet pale bluish olive; iris olive-brown.

Total length $4\frac{1}{2}$ inches; wing $2\frac{1}{10}$ inches; bill, to front, $\frac{3}{8}$ inch.

*Hab.* Menado (North Celebes).

ZOSTEROPS GRAYI.

"*Z. citrinella*, Müll.," G. R. Gray, P. Z. S. 1858, p. 175.

*Flavo-viridis, subtus albescens; capite fuscescente; fronte, gula, uropygio et crisso flavis; remigibus rectricibusque fuscis, flavo-marginatis.*

Much larger than *Z. citrinella* from Timor. Crown of head darker; wings and rump yellower; bill black; pale at base of lower mandible; feet pale lead-colour. The comparative dimensions of the two species are as follows:—

| | Total length. | Wing. | Tail. | Bill. | Tarsus. |
|---|---|---|---|---|---|
| *Z. grayi* . . . . . | 5 in. | $2\frac{1}{2}$ in. | 2 in. | $\frac{5}{10}$ in. | $\frac{8}{10}$ in. |
| *Z. citrinella* . . | $4\frac{1}{4}$ in. | $2\frac{1}{8}$ in. | $1\frac{6}{10}$ in. | $\frac{4}{10}$ in. | $\frac{6}{10}$ in. |

*Hab.* Ké Island.

*Remark.*—I have named this bird after Mr. George Robert Gray, from whose writings and personal information I have derived much assistance.

DICÆUM IGNIFERUM.

*Supra nigro-cyaneum; capite, collo, dorso medio et uropygio rubris; facie, colli lateribus et pectoris linea mediana fusco-nigris; mento, pectore inferiore et abdomine albis; gula rubra.*

Above blue-black; top of the head and the middle line of the back to the upper tail-coverts blood-red; sides of the neck and upper part of the breast dusky black; chin white; throat red, in a broad longitudinal stripe; rest of the underside white, the black of the breast being continued in a stripe down to the belly; bill and feet black.

The females or young males are more dusky above, with the red on the head and rump, but less distinct on the back; beneath white, with the face and breast dusky ash.

Total length $3\frac{1}{2}$ inches; wing 2 inches.

*Hab.* Flores.

*Remark.*—This species resembles *D. cruentatum* above, and *D. macklotti* beneath.

PTILOTIS VIRESCENS.

*Flavo-virescens, subtus pallidior; gula cinerea, abdomine crissoque albescentibus.*

Yellowish green; feathers of crown dusky, greenish-margined; throat ashy; breast pale yellowish green; belly and vent whitish;

quills and tail-feathers dusky, margined with olive-green; under wing-coverts and inner margins of quills white; iris dark; bill black; feet lead-colour.

Total length $5\frac{3}{4}$ inches; wing $2\frac{3}{5}$ inches; bill, from front, $\frac{4}{5}$ inch.

*Hab.* Lombock.

MUNIA PALLIDA.

*Rufo-cinerea, subtus pallide rufa; capite colloque albis, pectore albescente, crisso caudaque rufo-castaneis, uropygio et caudæ tectricibus superioribus intense sericeo-castaneis.*

Above rufous ash; beneath pale rufous; head and neck white; breast tinged with rosy ash; tail and under tail-coverts dark rufous; rump and upper tail-coverts glossy chestnut-brown; bill and feet blue-lead; iris dark.

Total length $4\frac{1}{8}$ inches; wing $2\frac{1}{5}$ inches.

*Hab.* Lombock and Flores.

*Remarks.*—Very near *Munia maja*, L., but differs in the much paler colouring of both upper and under surface.

AMADINA INSULARIS.

*Fusco-cinerea, subtus albida; gula et pectoris lateribus cinereis, macula pectorali nigra undulata; macula magna auriculari, antice nigro marginata, rufa; lateribus castaneis albo guttatis; crisso albo et nigro variegato; tectricibus caudæ superioribus valde elongatis, nigris, albo maculatis, subfasciatis.*

Very near *Amadina castanotis*, Gould, from Australia, from which it differs principally in the chin and throat not being banded. The female wants the rufous and black markings on the ear-coverts, flanks, and breast; iris reddish brown; bill coral-red; feet reddish white.

Total length 4 inches; wing 2 inches.

*Hab.* Timor and Flores.

ESTRELDA FLAVIDIVENTRIS.

*Similis* E. puniceæ *ex Java, sed ventre dilute rubro-flavescente, tectricibus caudæ inferioribus nigris albo et rubido maculatis, rectricibus albo terminatis.*

Ashy brown; head and back red-tinged; face, throat, breast, and rump deep red; lower breast, belly, and vent yellow, washed with red; wing-coverts, tertiaries, sides of breast, and flanks with numerous round white spots; under tail-coverts black, with more or less white at the base and apex of each feather, and sometimes tinged with red; the four outer tail-feathers on each side rather broadly white-tipped; bill blood-red; feet very pale reddish; iris red.

Total length 4 inches; wing $1\frac{3}{4}$ inch; tail $1\frac{3}{8}$ inch; bill, to front, $\frac{3}{8}$ inch.

*Hab.* Timor and Flores.

*Remarks.*—In some specimens the white spots spread over the

whole neck and breast. The species is most readily distinguished from *E. punicea* by the reddish-yellow belly. It is rather abundant in the grassy valleys of Timor.

Treron floris.

*Flavo-viridis; dorso fusco, interscapilio cinereo tincto; pileo plumbeo, fronte albescente; alis nigris, remigibus secundariis et tectricibusque alarum pallide flavo marginatis; rectricibus lateralibus cinereis medialiter nigro fasciatis; femoribus tectricibusque caudæ inferioribus albo et viridi maculatis.*

♀. *Dorso fusco-virescente, minime cinereo.*

Beneath pale yellow-green; top of head lead-colour; forehead, chin, and gape whitish; upper part of back ashy green; the rest, upper wing-coverts, and tertiaries dusky green; rump and upper tail-coverts bright yellow-green, as well as the four middle tail-feathers; lateral tail-feathers with the basal half dusky ash, a median black spot or band, and the apical portion whitish ash; tail beneath black, broadly tipped with ashy white; under tail-coverts green, broadly margined and tipped with white, as are also the thighs and lower part of the belly; quills black, the primaries finely white-edged, the secondaries and greater and middle coverts rather narrowly bordered with pale yellow; bend of wing ashy purple; underside of wing entirely slate-colour; bill with the tip yellowish; orbits bare; feet red, as in *Treron griseicauda*.

Total length 11½ inches; wing 6 inches.

*Hab.* Flores and Solor Islands.

*Remarks.*—The sexes are alike, the female only differing in the rather duskier back and more green-spotted under tail-coverts. In the form of the bill and frontal feathers this species agrees with *T. nepalensis* and *T. griseicauda*, and in coloration can hardly be distinguished from the female of the latter species. It is singular that in the Island of Timor an allied species (*T. psittacea*, Temm.) should be found which also wants the chestnut-coloured back in the male, the habitats of both agreeing closely in their peculiar climate and vegetation.

Ptilonopus albocinctus. (Pl. XXXIX.)

*Æneo-niger; collo latissime pectoreque cæsiis; capite albescente; gula, torque pectorali et tænia dorsali albis; ventre et femoribus flavo-olivaceis, tibiis cinereis; tectricibus caudæ inferioribus cinereis late flavo marginatis, cauda fascia terminali cinerea.*

Bronzy black; crown and forehead ashy white; throat and cheeks white; neck and breast bluish ash, with a narrow edging above and a broad band beneath white; below this a broad blue-black band on the lower breast; belly and thighs olive-yellow; legs ashy; under tail-coverts ashy with broad margins to the feathers bright yellow; tail with a terminal ash-coloured band, which on the underside is nearly white; bill greenish at base, yellow at tip; feet bright red.

Total length 12½ inches; wing 6 inches (the first quill moderately attenuated at the tip); tail 4¾ inches.

*Hab.* Flores (in the interior only).

*Remarks.*—This fine new species is closely allied to *Columba cincta*, Temm., of the adjacent island of Timor, differing principally in the delicate bluish colour of the neck and breast, and structurally in the form of the first primary, which in *P. cinctus* is much more abruptly acuminated. A single specimen only was obtained.

TURNIX RUFESCENS.

*Supra fuscus, subtus rufescens; plumis dorsi nigro maculatis et luteo-rufo marginatis, tectricibus alarum fulvo terminatis et nigro maculatis aut lunulatis; pectore rufo, lateribus nigro lunulatis; pectore et abdomine medio albescentibus; alis fusco cinereis, prima remigum fulvo marginata.*

Above dusky; feathers irregularly black-marked, on the back margined with pale rufous; beneath rufescent; throat and middle of the belly whitish; breast bright rufous, towards the side with black lunules; flanks with broad blackish bands; wing-coverts with fulvous tips, with rounded black spots and lunules; quills dusky, the first yellow-margined; the tertiaries mottled on the margins with rufous and black; bill dusky, yellow at base; feet pale yellow; iris dark.

Total length 5 inches; wing 3 inches; bill, to gape, $\frac{6}{10}$ inch; mid toe and claw $\frac{7}{10}$ inch.

*Hab.* Samao Island (Timor).

MACROPYGIA MAGNA.

*Fusco-brunnea, nigro et rufo undulata; cauda pallidiore, unicolore; pileo rufo; subtus dilute brunnea, fusco et albo undulata, tectricibus alarum inferioribus et remigum marginibus rufo-castaneis; tectricibus caudæ inferioribus rufis, ad basin fusco undulatis; rectricibus duabus exterioribus utrinque in margine interiore macula elongata schistacea.*

Dusky brown, banded with blackish and rufous; tail uniform pale earthy brown; top of head rufous: beneath light ochre-brown, banded with whitish and dusky at the end of each feather; quills blackish, with a narrow white edge; entire base of the wings beneath chestnut-brown, which extends on to the inner margins of the primaries; under tail-coverts rufous, slightly banded at the base; tail-feathers rufescent towards the base, the two outer feathers on each side with an elongate slate-coloured spot on the inner margin; bill blackish; feet pale pink-red.

Total length 17 inches; wing 7½ inches; tail 8½ inches; bill, to front, $\frac{7}{10}$ inch.

*Hab.* Timor.

## 4. On some new Australian Species of Crustacea. By C. Spence Bate, F.R.S., F.L.S., etc.

(Plates XL. and XLI.)

The following species of Crustacea were collected and sent to the British Museum by Mr. Angas, who obtained them during his sojourn in Australia. *Angasia pavonina* is figured from a coloured drawing taken of the animal, while living, by Mr. Angas; the others are from preserved specimens by the author.

### Angasia, White.

Hippolyte *similis, sed rostrum sine carina dorsali, et sine appendice ad mandibulam.*

Like *Hippolyte*, except that the dorsal surface of the carapace is horizontally continuous on the rostrum, and gradually converges laterally to a point, and the mandibles are without any secondary appendage.

This genus was founded by Mr. Adam White, and orally described by him at a Meeting of the Zoological Society, for the purpose of receiving a very pretty species that was brought from Australia by Mr. Angas.

The arrangement in this memoir differs from that of Mr. White in making the form a genus instead of a subgenus. This I do, first, because a subgenus appears to be both an inconvenient and an unnatural arrangement; and second, because whenever there is any structural distinction, however unimportant it may appear to be to our cognizance, yet it is impossible to classify such a species together in a genus with others not possessing the same structure. For quick detection, no doubt variation in form may be more appreciable for observation than an alteration of structure; but it stands to reason that the latter, however small, must be far more important in the economy of the animal's life than the former. It must also be taken into consideration that we seldom find any structural alteration, however small, without perceiving a more or less important variation in the condition of some other part of the same animal.

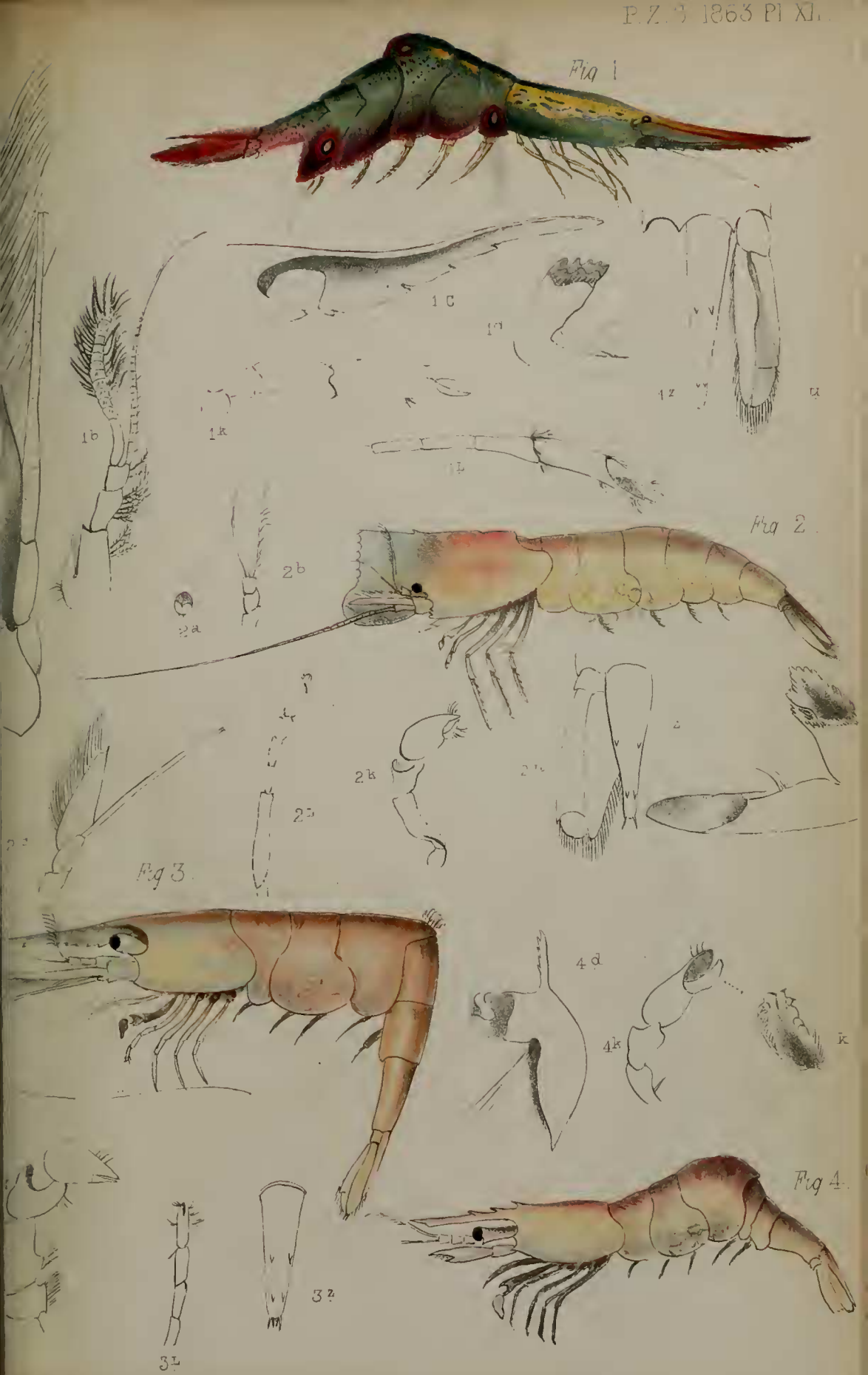
This genus is closely allied to *Hippolyte*, from which the most palpable distinction exists in the absence of the carinated ridge that traverses the rostrum and the dorsal surface of the carapace, and in the more important feature of the absence of the apparently insignificant appendages attached to the mandible.

### Angasia pavonina. (Pl. XL. fig. 1.)

A. *rostro tam longo quam carapax, et antenna inferiore tam longa quam pars dimidia pleontis sui.*

Length $2\frac{1}{2}$ inches.

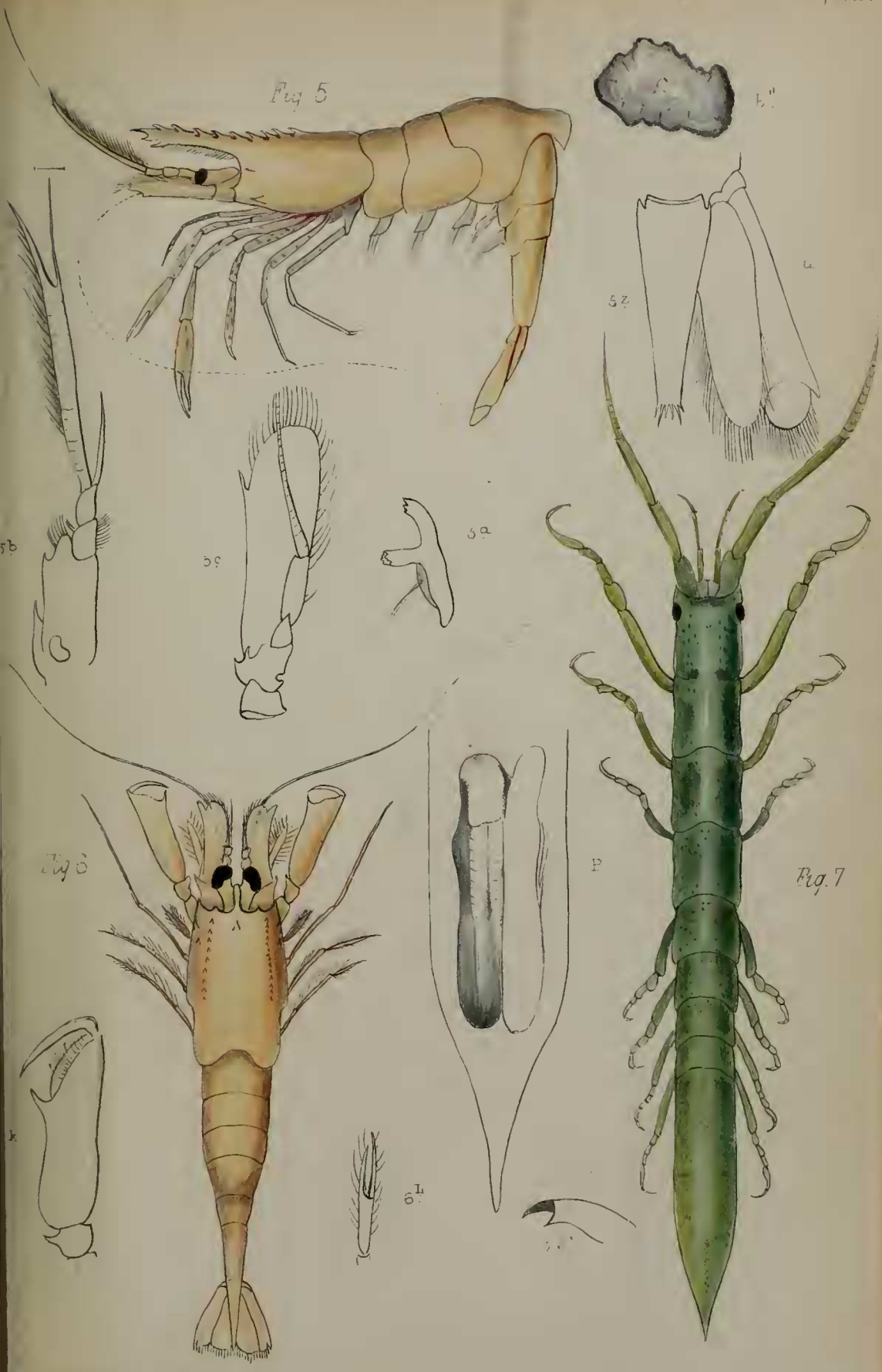
This, the only species that has been found, has the rostrum quite as far projecting in advance of the eye as the carapace extends posteriorly to it, with a deep carina upon the inferior surface, having the margin furnished with four small teeth. The eye is elevated upon a




Smith lith ad nat.

M&N Hanhart Imp

NEW AUSTRALIAN CRUSTACEANS




Smith, lith ad. nat.

M&N Hanhart imp

NEW AUSTRALIAN CRUSTACEANS

long peduncle. The superior antenna is short, the extremity of the flagella reaching scarcely more than half the length of the rostrum, and scarcely longer than the peduncle, the first joint of which is armed with a tooth as long as the joint. The inferior antenna has the squamiform appendage reaching nearly to the extremity of the rostrum, and the flagellum reaching more than the length of the rostrum beyond it. The mandible differs from that of *Hippolyte* in the absence of the small secondary appendages, and in having the molar surface more denticulated and less furnished with hairs. The second pair of gnathopoda are flat or spatuliform, fringed at the apex with eight or nine robust teeth. The first pair of pereiopoda are short, robust, and chelate, having the propodos longer than the carpus. The second pair are long, slender, and chelate, having the propodos shorter than the carpus. The remaining three pairs of pereiopoda are shorter than the second, and slightly more robust, and terminate in simple unguiculate dactyli; the inner surface of the carpi and propodi are armed with spines, those on the carpi being all equally long and strong, while those on the propodi gradually increase in length towards the distal extremity. The pleon has the lateral walls of the first five segments deeply produced, those of the fifth being quite as deep again as the body. The posterior pair of pleopoda are rather longer than the telson, and fringed with cilia, except upon the outer margin of the outer ramus. Telson longer than the last segment of the pleon, terminating in an obtuse point, and armed near the central and terminal margins with two pairs of short spines.

Mr. Angas, who took this very beautifully coloured species, describes it as of a "rich green, between apple and malachite, darker on the back, chrome-yellow and gamboge nose and lines along the back, then cobalt-blue, the rostrum being tipped with crimson. The eye-like spots upon the sides and back rivalled in brilliancy those of the peacock's tail; the centre was filled with intense peacock-blue and green, surrounded by a black ring, then one of crimson-scarlet, the side of each segment being coloured with exquisite purple that shades into a more or less rosy violet, the telson and posterior pair of pleopoda being crimson." Unfortunately it is difficult to retain colour in Crustacea; consequently all this brilliancy of tinting disappeared in about twelve hours. Three specimens of this species were dredged by Mr. Angas in St. Vincent's Gulf, in April 1861, four miles from the shore, on a weedy bottom, in $4\frac{1}{2}$ fathoms of water.

The description is taken from the largest specimen. The other two differ from the type, not only in size, being smaller, but also in the depth of the lateral walls of the fifth segment of the pleon.

### Genus Caradina, Edwards.

Division A. *Without second appendage or process to the mandible.*

Caradina truncifrons. (Pl. XL. fig. 2.)

C. *rostro tam alto quam cephalon, margine anteriore truncato et serrato, margine dorsali uno dente instructo.*

Length $\frac{3}{4}$ths of an inch.

Rostrum deeper than the cephalon, the extremity being the deepest part; the anterior margin slightly excavate, and armed with nine small teeth. The rostrum is also furnished with a tooth upon the dorsal surface, immediately above the eyes. The pleon is robust, and but slightly curved. The eyes are small, and planted upon a short peduncle. The superior antennæ reach beyond the extremity of the rostrum. The inferior antennæ are imperfect, but are at least more than one-third the length of the animal; the squamiform appendage is acuminate, subapically tipped with a tooth, and reaches to the extremity of the rostrum. The first pair of gnathopoda are short, spatuliform, the distal extremity being fringed on the inner margin with small but strong spines. The first pair of pereiopoda are much shorter than the second, and by their peculiar formation afford the distinctive character that distinguishes this genus from *Hippolyte*: the propodos is long, ovate, and attached to the inferior process of a hollow or widely crescent-shaped carpus; this is ovate, slightly tapering to the dactylos, which is internally concave, and impinges against a similarly formed process of the propodos. The second pair of pereiopoda are longer than the second gnathopoda, slender and chelate, the propodos being stoutest at the carpal extremity, from which it narrows to the dactylos, which is internally hollow or spoon-shaped, and antagonizes with a similarly shaped process at the extremity of the propodos. The three posterior pairs of pereiopoda are longer and rather more slender than the preceding, are armed upon the posterior margin with five or six equidistant solitary spines, and terminate in an unguiculate dactylos; the posterior pair of pleopoda are about the same length as the telson. Telson terminating obtusely, armed with two strong spines at the apex, and subapically furnished with a short cilium.

The colour of this species when alive was not recorded by Mr. Angas; but since death it has assumed an orange tint, deepening to a red along the line of the primæ viæ.

This description is taken from a female loaded with ova, amongst which were found two specimens of the larva of a Bopyroid Crustacean.

This animal, like the preceding, was captured in about $4\frac{1}{2}$ fathoms of water in St. Vincent's Gulf, on weedy ground, about four miles off the land.

Division B. *Having a fixed denticulated second process on the mandible.*

Caradina cincinnuli. (Pl. XL. fig. 3.)

C. *rostri margine dorsali lævi et cincinno parvo supra extremitatem tertii segmenti posteriorem regionis dorsalis. Pleontis antenna superiore quam rostrum longiore, antenna inferiore quam corpus breviore.*

Length $\frac{3}{4}$ths of an inch.

The back of the carapace is smooth, projecting anteriorly into a rostrum that is only carinated below and armed with six teeth. The pleon is likewise smooth; but the third segment is slightly gibbose,

and furnished upon each side of the central line with a small tuft of hair, from which circumstance the specific name is derived. The eyes are large and prominent. The superior antennæ have the primary appendage but half the length of the secondary, The inferior antennæ have the squamiform appendage reaching quite to the extremity of the rostrum, rounded at the apex, and furnished with a sharp tooth one-third from the extremity, and have the flagellum more than half the length of the animal. The mandible is furnished with a short, fixed, small, anteriorly directed process. The first pair of pereiopoda are short, robust, and have the propodos long ovate, narrowing slightly towards the dactylos, and articulating upon the inferior process of the deeply concave anterior margin of the carpus. The second pair of pereiopoda are longer and more slender than the preceding, and have the propodos not larger than the carpus. Posterior pair of pleopoda rather longer than the telson. Telson terminating in two or three small spines.

This species was taken with the preceding, with which it generally agrees in structure, except in the formation of the mandible, which in this specimen has a small anteriorly directed process. This addition, being one of structure, I consider to be sufficiently important to distinguish the present species generically from that of the preceding; but since Milne-Edwards, in his character of the genus *Caradina*, has not described the form of the mandible, it is difficult, until an opportunity offers of examining a specimen of the original species of the genus, to determine which of the two forms of mandible belongs to the type. I have therefore thought it desirable to classify them under Divisions A and B, rather than make a new genus, which must, under the circumstances, be equivocal. Division B approximates in the character of the mandible more nearly to that of the genus *Hippolyte* than Division A.

This description is taken from a female specimen loaded with ova; and if we may judge from the majority of specimens in the small collection being so furnished, we should imagine the month of April, in which they were taken, to be a favourable period for their production.

The colour of this species has not been recorded from the living animal. In its preserved state it is yellowish, blushed with red along the dorsal surface and *primæ viæ*. It was taken, with the previous specimen, in Gulf St. Vincent.

### Caradina tenuirostris. (Pl. XL. fig. 4.)

C. *rostro supra dentibus tribus apud basim et infra uno dente apud apicem armato.*

In this species the rostrum is long, slender, and armed with three teeth upon the upper surface near the base, and one upon the under surface near the apex. The pleon is gibbous at the third segment, being slightly produced posteriorly, and dorsally compressed. The eyes are large and prominent, having the peduncle quite half the length of the rostrum. The superior antennæ are one-third longer